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Co-operative Compensation Insurance

WHEN the workmen's compensation act became effective in New York State the public utilities were vitally interested. This, like other acts, was of rather uncertain portent. To a considerable extent it has worked to the advantage of the workman and also to the advantage of the insurance companies, which take no chance on a somewhat unfamiliar type of risk. As the situation developed the Utilities Mutual Insurance Company was organized as a measure of self-defense, and it has now more than a hundred electric and gas companies in its membership. The plan was to work on a thoroughly businesslike basis, forming a genuine mutual compensation company, working directly along this line without any side issues. It pursued the policy of charging the ordinary company premiums and then, after establishing adequate reserves and paying losses, distributing part of the surplus as a dividend to its members.

In this way the insurance was obtained on a basis at least no more disadvantageous than if it had been obtained in the open market, and, as in many cases of mutual organizations, it has proved that the actual net cost of insurance was very much below market rates. Part of this saving, 20 per cent or more, has been returned in the form of dividends for the last four years, besides leaving a substantial surplus. This success was undoubtedly due in a measure to the fact that the receipts were on the whole better than the average, and still more to the sound conservative management which furnished insurance at cost instead of at premiums exaggerated by enormous loads for the benefit of the stock company. These loads have in general to represent, not favorable conditions, but the worst which can possibly be encountered in the company's business, so that the advantage of co-operative working in a class of rather favorable risks is particularly obvious.

Not a little of the good result obtained is due to the instinctive feeling among all the participating companies that inspections and precautions to avert accidents would be directly to their benefit. The inspecting force was known to all participants as having for its fundamental motive, not blind adherence to a group of specifications intended to meet the worst possible conditions, but genuine interest in endeavoring to cut down the risks to which the member companies were exposed. Each company was examined at least twice a year, never twice in succession by the same man, and the recommendations made by the inspectors were directed closely to the lessening of danger. The scheme entered into in a tentative way to try out a remedy for a difficult situation has "made good" on the face of the returns, and there is no reason to suppose that an extension of the activities of similar enterprise elsewhere will not likewise find a most encouraging reward.

Edison Medal Presented to Colonel Carty

THE presentation of the Edison medal last week to Col. John J. Carty met with universal acclaim, and the event is sure to be noted with satisfaction by all our readers. Colonel Carty, as the chief engineer of the American Telephone & Telegraph Company and as a junior past-president of the American Institute of Electrical Engineers, is known to electrical men all over the world. His contributions to telephone engineering have been numerous. As an organizer and administrator he has revealed great ability. His discernment, foresight and intuition in telephone engineering have been remarkable. Moreover, as a man he unites in an extraordinary degree the patient, persistent working power of the designing engineer with the sympathies and artistic instincts of the poet. He is the eighth on the list of eminent electrical men to receive the award of the Edison medal.

The occasion and ceremonies at the Institute meeting were brilliant and memorable. As our readers are informed, the results of the annual election for A. I. E. E. officers were announced. The president-elect, Prof. C. A. Adams, received a cordial welcome, and his brief address of acceptance and response met much applause. When Colonel Carty was escorted to the platform by Dr. Carl Hering, the chairman of the Edison medal committee, it was before a distinguished audience of ladies and gentlemen, among whom were many well-known telephone engineers, that the formal presentation was made. This was preceded by a eulogistic speech by Dr. Pupin, describing some of the recipient's well-known qualifications. E. W. Rice, Jr., the retiring president, delivered the medal and diploma. Colonel Carty's speech of acceptance displayed at once his characteristic modesty and his clear breadth of vision. He pointed out the great forces which telephony and telegraphy exert, and the yet greater forces which they are capable of exerting, for the world at large; also how much science and art, study, discipline and co-operation were needed in order to improve and maintain the service of telephony.

By good fortune both Dr. Alexander Graham Bell and General Squier were on the platform. Allusions to these well-known men and to their work drew repeated

applause. Dr. Bell was prevailed upon to make a short speech, which closed the proceedings very happily. The committee on arrangements deserved great praise for the excellence and precision of the function.

Electrical Transportation Can Help Win the War

AT OUR railway terminals, on our city streets, in our factory yards, we have got to handle and haul goods faster and cheaper. The central station has a vital part in this. It doesn't have to sell trucks; it doesn't have to sell conveyors; it doesn't have to spend money. All that is necessary is that every man from top to bottom shall see that electricity for power for transportation is to-day economically as sound as electricity for light and for motor drive, for domestic devices and electric furnaces; that the trucks and batteries of to-day are not the trucks and batteries of ten years ago; that gasoline and skilled men are getting scarcer except for primary war purposes, and that the self-propelled electric motor vehicle is succeeding on sheer intrinsic merit as the cheapest and simplest method of handling short-haul, many-stop deliveries.

Faster and cheaper methods of transportation will help win the war. The railroads are but one link in the transportation system that begins at the shipping platform of the factory and ends at the business warehouse and the customer's door. Our transportation system to-day needs help—real help—first, to make more efficient our present systems; second, to replace outgrown systems with newer and more economical methods.

The self-propelled vehicle is being demanded as an aid to rail transportation in government work, in munitions plants and in other essential war-time industries. The gas truck is called upon for actual army needs for long, rough transportation. The electric truck is needed for short-haul city transportation. The industrial storage-battery truck makers are swamped with business for this specialized transportation in mines, warehouses and factories. The short-haul, many-stop delivery systems are being analyzed by government boards and by individual business men, and the opportunity for heavy 5-ton electric trucks to-day has outstripped factory production. The specialized tractor field—the tractor for hauling wagons—is being developed, and fleets of light electric trucks for mail, express and merchandise deliveries have proved their economy over and over again.

The central stations are furnishing electricity for power and lighting for war work under many extraordinary conditions. They must furnish energy for transportation at a near date. As a load, it is well known, the battery charging meets war-time conditions. It is off-peak. Besides being good business to-day to promote electrical transportation methods, it is patriotic. Electricity is helping to win the war, in air photography, in wireless, in telephony, in big-gun firing on land and sea, and in the economical furnishing of energy for power, light and heat from a central station. To this we add, with peculiar importance at this time, the supply of energy for transportation. The electric telpher, the battery-driven industrial truck, the heavy-duty truck and the light delivery wagon are needed.

Self-Inductance of Short Reactance Coils

WHEN a coil has a core of non-magnetic material, such as wood or air, its self-inductance becomes a definite quantity and one which often assumes considerable practical importance. For example, in radio engineering the coils which carry high-frequency currents are ordinarily non-ferric or have non-magnetic cores. It is often requisite to know their inductances. Again, large reactors with non-magnetic cores are now commonly installed in large central stations to limit short-circuit currents. Their inductances have to be predetermined during design, within reasonable limits of error. The inductance of any coil may be regarded as expressing the sum total of linkages of magnetic flux with that coil when it is excited by unit current.

Not long ago H. B. Dwight published in our columns a useful set of engineering formulas for deriving the inductance of a long coil. A coil may be defined as long for the present discussion when its axial length exceeds its mean winding diameter. Per contra, a coil whose axial length is less than its mean winding diameter becomes defined as a short coil. In this number Mr. Dwight contributes a similar set of useful engineering formulas for finding the inductance of a short coil. Three formulas are given, as well as a convenient curve sheet for approximate evaluation by inspection.

It may be noted that, as usual, the calculation can be simplified if the mechanical measurements of the coil are expressed in centimeters instead of in inches, because the numerical factor 0.3937 in the denominator of each formula then becomes replaced by unity, and if, further, the result is looked for in abhenries, instead of in henries, the denominator outside the main bracket in each formula disappears or is replaced by unity. This is merely another way of saying that since the henry, like all the international electromagnetic units, is a metric unit, it is simpler and swifter to use the metric system than the English system of units in electrical engineering calculations.

Great Market for Low-Priced Appliances

THERE has been a very large development of small motors for the application of electricity to small devices and appliances. To enumerate a few of the scores of devices now on the market is to suggest this tremendous growth. The fan, the hair drier, the vacuum cleaner, the washing machine, the ironer, the floor polisher are typical of home labor-saving appliances; the adding and calculating machine, the ventilating fan, the duplicating machine are samples of office and business devices; the coffee mill, the cash carrier, window display racks, intermittent signs are contrivances sold in increasing numbers in stores; and the industrial and specialized applications of small motors for tools in factories are as varied as industry itself. The universal motor, the motor that operates on both alternating and direct current, has been developed for these uses. But the field of application is barely scratched because these applications, with perhaps the exception of the fan, are relative luxuries to the average buyer.

The proportionate numbers of buyers for any com-

modity may be represented as a pyramid. At the apex are the few wealthy buyers to whom price makes relatively small difference in purchases. At the base are the utility buyers who have to match pennies with their wants of food, shelter and clothing. In between these extremes is a great middle class tapering in income toward the very rich at the top of the pyramid and toward the very poor at the base. The bulk of the merchandise that makes any pretense of having convenience as well as utility value is sold to this middle-class group. Very few electrical contrivances are priced in this field, for two reasons—first, because the first market has been in the relative luxury class; second, because the small volume of sales has made costs high.

All this is background for the small-motor designer. In our industry electrical design is linked very closely with merchandising demand, because electrical design gets at the root of costs, costs have definite relation to price, and price has a definite relation to sales volume. So we complete the circle and get back to design. We need to-day, and will need increasingly, good small motors that can be built and sold more cheaply, not because costs are too high for present markets, but because if we are to get down into the bulk utility markets we must have five-dollar, ten-dollar and fifteen-dollar motor-driven appliances. In many of these devices the motor is 50 per cent or more of the assembled factory cost. Our small-motor designers have done some remarkable things. There are certain irreducible relations between copper and iron to get output. There are definite limits of efficiency. But our designers have the problem of scaling efficiency and cost in such proportions that, given quantity production, a good small motor can be produced which will put the small power appliances in the great middle-class buying group.

Precautions to Insure Safety in Switching

THE article by M. M. Samuels and F. N. Bechoff in the current issue is full of practical ideas for the assurance of safety in performing various switching operations and of plans for interlocking the various devices so that they cannot be mishandled. The diagrams of safety and interlocking devices which the authors give will be found very suggestive by those who are dealing with switchboard design. The fact is that switchboard design is a fine art rather than a science and one which even now is in anything but its final stage of development. There are plenty of standard panels for ordinary purposes which leave little to be desired in completeness; but a standard panel is not a switchboard, neither is it a simple proportional part of the switchboard, and when it comes to laying out the various interconnections for a considerable station there is room for exercise of indefinite ingenuity. It is in the organization of a complete switching system that practical hints like those in the present article will prove of a good deal of service, not only in themselves, but in suggesting still further possibilities of lessening risks and providing a more easily worked switchboard equipment. The interlocking idea in particular is worth development. For example, it is perfectly practicable to use for certain purposes simple and cheap auxiliary switches provided that they are not expected to open the circuit under heavy load. If interlocked so that this particular thing cannot be done, the cost of an expensive oil switch may be saved to the plant.

The only danger lies in carrying the elaboration of safety devices so far that the entire system gets more complicated instead of less so. One cannot entirely eliminate human intelligence in the operation of a switchboard, and it sometimes seems to us a question as to whether an attempt to do so is not likely to lead to too much blind confidence in things going right even if the operator does not think. In certain cases—for instance, the operation of an automatic substation—the working of the switching apparatus must be completely automatic. The distant operator pushes a button, and the motor it controls does the rest. If one tries to reduce an entire switchboard to this condition, there is still left the chance of the operator pushing the wrong button and starting the wrong irrevocable train of operations into action, losing time if nothing worse. Here, as everywhere else, the human equation cannot be eliminated, and a sense of personal responsibility may be a more valuable factor in safe and successful operation than mechanical contrivances of too complicated a nature.

We are quite disposed, therefore, to believe that in the long run the best policy is to work assiduously in the direction of extreme simplicity in the general layout of the switchboard, thereby decreasing not only the labor of the operator but the chances of his doing the wrong thing. These chances may be still further diminished by intelligent use of safety devices and by employing fully automatic switching apparatus when, and only when, it really makes for simplicity instead of complication. In old stations grown by a process of aggregation complication cannot be avoided and there is free scope for the exercise of much ingenuity in providing for safe operation. In new stations the watch dog of the treasury ought to be on guard over the switchboard designer, ready to show his teeth at the first symptom of unneeded intricacy.

The Coming Issues

IF ALL of the brass and bronze in the United States were to be melted in electric furnaces, the annual consumption of energy would be about 200,000,000 kw.-hr. and the generating capacity required would be about 75,000 kw. These figures give some idea of the importance to user, manufacturer and central station of knowing the fundamental principles which govern the success of electric brass melting. These will be outlined in a coming issue in which the relative merits of different types of furnaces will be discussed and the central-station viewpoint presented. Among other articles that will appear shortly will be one telling what types of lighting units or layouts are best suited for protective lighting purposes and another describing some interesting long-span construction leading up the side of a mountain broken by ravines and covered with tall trees. The second and concluding installment of Prof. N. S. Diamant's article on "Sudden Short Circuits of Alternators" will appear in the next issue.

Determination of Economical Power Circuits

Method of Deriving Curves Which Show the Most Economical Wire Size When the Cost of Copper Wire, the Cost of Energy at the Switchboard, the Equivalent Hours During Which Load Is on Circuit and the Maximum Current Are Known

BY P. O. REYNEAU
Distribution Engineer, Detroit Edison Company

IN AN article* previously published an attempt was made to determine the economical size of feeders for a load consisting of residence and store lighting. These feeders were single-phase and carried a uniform load throughout their length, being the link between the substation and the distribution center. The analysis was made on the basis of the peak load intended to be carried on these feeders and what was called the "equvalent" hours that the load was carried on them. The equivalent hours times the maximum current squared is approximately equal to the actual I^2r loss due to the varying current throughout the day.

Here the same general method will be used for three-phase circuits carrying power load and a very small amount of factory lighting. As previously established, the most economical size of wire is that for which the sum of the fixed charges and the energy losses at the switchboard cost is a minimum. This sum represents the annual charges.

The current that can be carried on these circuits is limited by the current-carrying capacity of the cables feeding out of the substations, which are 200,000-circ. mil three-wire cables. Various sizes of wire are considered, No. 0000 being taken as the largest size that can be handled on existing pole lines without special reinforcement. In this manner the pole-line cost is considered the same for all sizes of wire and could be eliminated in the calculations.

The annual charges may be represented as follows:

Annual charges $= (K_1 + K_2)D$.

Where K_1 = annual fixed charge per 1000 ft. of line
$= (g/100)(3000 \times W \times C_c + H)$

K_2 = annual copper loss per 1000 ft. of line
$= I^2(\rho/A) \times 3000 \times t \times 300 \times C_e/1000$

D = distance of transmission in thousands of feet.

If

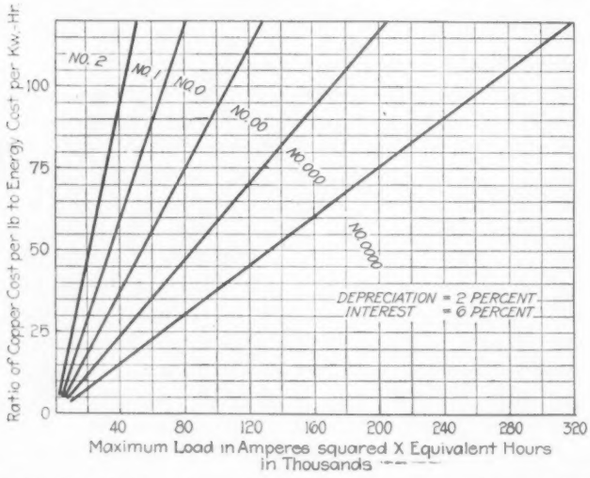
g = per cent interest and depreciation,
W = weight per foot of wire,
C_c = price of copper wire per pound,
H = cost of stringing 1000 ft. of line,
I = maximum current carried,
ρ = resistivity of wire in ohms per mil-foot,
A = area of wire in circular mils,
t = equivalent hours per day peak load is on,
C_e = cost of energy per kilowatt-hour,
and working days are taken as three hundred per year.

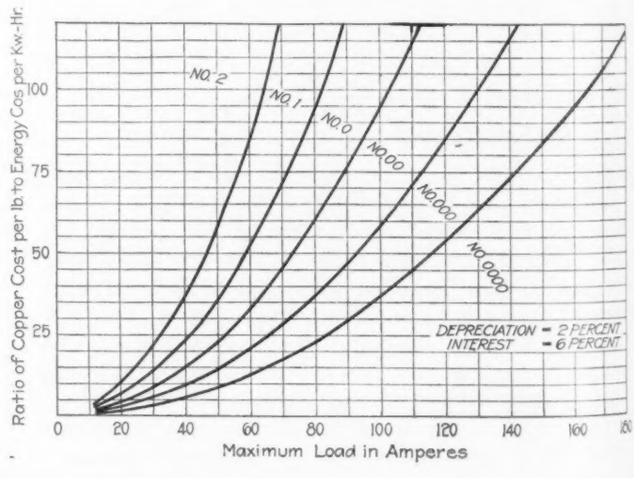
The formula for annual charges becomes:

$$\text{Annual charges} = [(g/100)(3000 \times W \times C_c + H) + I^2 \times (\rho/A) \times 3000 \times t \times 300 \times (C_e/1000)]D$$
$$= [30gWC_c + (gH/100) + 900I^2(\rho/A) \times t \times C_e]D.$$

Assuming that for one size of wire $W = W_1$ and $A = A_1$, and for the next larger size $W = W_2$ and $A = A_2$, then:

$$\text{Annual charges (1)} = [30gW_1C_c + (gH/100) + 900I^2(\rho/A_1)t \times C_e]D.$$





FIGS. 1 AND 2—ECONOMICAL SIZE OF CONDUCTOR FOR THREE-PHASE POWER CIRCUITS WITH ANY RATIO BETWEEN COPPER AND ENERGY COST. FIG. 1 HOLDS FOR ANY VALUE OF EQUIVALENT HOURS, FIG. 2 APPLIES WHEN EQUIVALENT HOURS EQUAL 9.69

$$\text{Annual charges (2)} = [30gW_2C_c + (gH/100) + 900I^2(\rho/A_2)t \times C_e]D.$$

If these two quantities are equated, a point is obtained where it is as economical to use either wire size, considering the same C_c, C_e, I and t.

Annual charges (1) = annual charges (2)

$$[30gW_1C_c + (gH/100) + 900I^2(\rho/A_1)t \times C_e]D = [30gW_2C_c + (gH/100) + 900I^2(\rho/A_2)t \times C_e]D \quad (1)$$

Since C_c and C_e are not constant and I and t depend on the load, it is advisable in order to make the equa-

*See ELECTRICAL WORLD, Dec. 15, 1917, p. 1142.

tion most usable to solve equation (1) for the ratio of C_c/C_e, thus leaving two troublesome variables in a convenient form for substitutions.

Then:

$$30gC_c(W_1 - W_2) + 900I^2t \times C_e\rho[(1/A_1) - (1/A_2)] = 0;$$

or

$$C_c/C_e = \frac{900 \times \rho \times [(1/A_1) - (1/A_2)] \times I^2t}{30g \times (W_1 - W_2)}$$

$$= \frac{30\rho(A_1 - A_2)}{g \times A_1A_2(W_1 - W_2)} \times I^2t,$$

or, equating the expressions

$$K = \frac{30\rho(A_1 - A_2)}{g \times A_1A_2(W_1 - W_2)}$$

A constant for each size of wire under consideration can be obtained, leaving only the four main variables to be considered $C_c/C_e = KI^2t$, as follows:

$$K_1 = \frac{30 \times 10.8 \times (211{,}600 - 167{,}800)}{8 \times 211{,}600 \times 167{,}800\ (0.6405 - 0.5079)} =$$
0.000378 (No. 000 to No. 0000).

$$K_2 = \frac{30 \times 10.8 \times (167{,}800 - 133{,}100)}{8 \times 167{,}800 \times 133{,}100\ (0.5079 - 0.4028)} =$$
0.000596 (No. 00 to No. 000).

$$K_3 = \frac{30 \times 10.8 \times (133{,}100 - 105{,}500)}{8 \times 105{,}500 \times 133{,}100\ (0.4028 - 0.3195)} =$$
0.000955 (No. 0 to No. 00).

$$K_4 = \frac{30 \times 10.8 \times (105{,}500 - 83{,}690)}{8 \times 105{,}500 \times 83{,}690\ (0.3195 - 0.2533)} =$$
0.00151 (No. 1 to No. 0).

$$K_5 = \frac{30 \times 10.8. \times (83{,}690 - 66{,}370)}{8 \times 83{,}690 \times 66{,}370\ (0.2533 - 0.2009)} =$$
0.002415 (No. 2 to No. 1).

With the equation in the above form it is possible to substitute for all the variables with the exception of t, which still remains to be determined. It is naturally assumed that a careful analysis has been made to ascertain the best cost of copper and of energy at the substation switchboard, or better still at the cable pole to be used in the substitution.

There are two courses open with regard to the equivalent hours or t to be used: First, an analysis of the power load on the system in question may be made to determine an average t to be used in the design of all power circuits. This was done here by analyzing the power load curve of the system, taking two typical days in each month of one year. If t_e = equivalent hours, I = average current for each hour, I_m = maximum current for the day, then the equivalent hours for one day can be represented as follows:

$$t_e = (\Sigma I^2R)/(I_m{}^2R) = (\Sigma I^2)/(I_m{}^2) \text{ or } =$$
$$[\Sigma(\text{kva.})^2]/[(\text{kva.}_{max})^2],$$

these two quantities being proportional to one another. Then, having the equivalent hours for each one of the twenty-four typical days of the year, an average can be obtained for the equivalent hours for the year. Fig. 3 gives a graphical representation of this process. By the preceding method 9.69 hours was found to be the equivalent hours for the various circuits of the system in question. Fig. 1 gives the means of finding the economical size of wire on that basis.

Secondly, to make the proposition absolutely general, curves can be plotted (Fig. 2) with C_c/C_e as abscissas and the quantity I^2t as ordinates, thus giving all possible combinations of the four variables C_c, C_e, I and t for the conditions previously described. The equation this time is a straight line.

The first set of curves serves as a general guide for average power circuits. It is best to use them on circuits where the character of the load is uncertain or when it is liable to change from time to time. The second set of curves allows of more refinement of design. In this case each power circuit can be designed separately if definite information or if plausible assumptions are available for determining the actual values of the equivalent hours. To do this it would be necessary to know the kind of load carried, its variation during the working hours and the working hours per day or the number of shifts. Serious error might result from assuming 9.69 as the average equivalent hours for a variable load, such as welders, or for a factory load running normally two or three shifts a day, such as furnace load, etc. Therefore the curve would be of service wherever a special analysis is possible, and the over-all efficiency of the system of power circuits would be greatly increased by separate study of each one.

So far only power circuits carrying the same load throughout have been considered, such as would exist with one large customer on the circuit. If the power circuit has several customers on it, and if it has

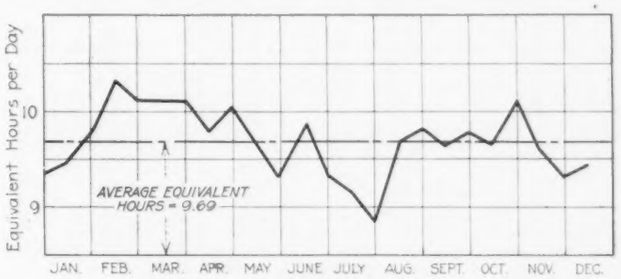


FIG. 3—EQUIVALENT HOURS PER DAY TAKEN FROM SYSTEM LOAD CURVES FOR ONE YEAR

branches, the load carried on each section of the circuit and on each branch should be analyzed and the most economical size of wire determined for each one of these parts. It is also possible to determine or make a plausible assumption of the equivalent hours for each part or branch.

Finally, it should be brought out that these curves only furnish a basis for obtaining the best economies in a system of circuits. They are sufficient in themselves for each circuit if the four variables C_c, C_e, t and I are known. They can only assist and guide in the design of a system of power circuits. The reasons are obvious and dictated by the quality of service to be furnished. In present-day practice, switching facilities and throw-over facilities are absolutely necessary in case of trouble and in many cases would demand wide divergence from the data obtained from the curves. However, if the correct relations between all the elements of power-circuit design that can be measured in tangible quantities can be established, the engineer is freer to work out his combinations and more apt to choose correctly the other elements, such as quality of service, etc., that cannot be measured in such exact sets of units.

ECONOMY OF CROSS-CONNECTED REVERSE-POWER RELAYS

Little Control Wiring Is Necessary—Practically Instantaneous Action Obtained—Relays Operate on Small Currents

WHEN the balanced system of relay protection is too expensive to employ on a network of feeders, cross-connected reverse-power relays may be used as shown in Figs. 1 and 2. In the particular example shown the relays are applied to a system consisting of a generating station and a substation connected by four parallel feeders. By referring to the diagrams mentioned it may be noted that all of the current transformers in the generating station and substation are connected in series and that each relay, which must be a reverse-power (unidirectional) relay, is shunted across its current transformer. This arrangement can be used with equal success in any part of a complicated network if the feeders are in parallel. While the cables in parallel should be alike in characteristics, any differences in their impedance can be easily compensated.

Under normal conditions the load in each of the cables

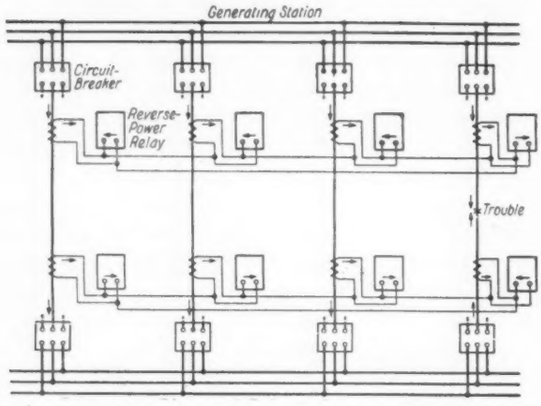


FIG. 1—SCHEMATIC DIAGRAM OF CROSS-CONNECTED SYSTEM SHOWING ONLY ONE PHASE OF EACH FEEDER

will be the same. Since the relays have a higher impedance than the current transformers, the current from the latter will therefore circulate through all of them in series without any flowing through the relays. If trouble occurs at any point outside the section protected by the cross-connected relays, the current through the cables will still be balanced; consequently there is no force tending to operate the relays. On the other hand, if trouble occurs on a cable within the section, the current through the defective cable will be higher than that in the others; therefore the excess current from the current transformers must pass through the relays. While under this unbalanced condition current will flow through all the relays, the current is in the proper direction to cause the opening action to occur only in the relays at each end of the defective cables.

The pallet switches shown connected in the transformer secondary circuit are also connected mechanically to the operating mechanism of the circuit breaker so that when the breaker opens the current transformers on the circuit controlled thereby will be short-circuited. Consequently a cable can be cut out of service without interfering with the electrical balance.

By referring to Fig. 1 it may be noted that when the cross-connected scheme is used on only two cables the two sets of relays are actually in parallel and will operate in the opposite directions. The expense of the two-cable cross-connected system can be reduced by using, in place of the two sets of reverse-power relays as shown in Fig. 3, one set of special relays having two contacts, one to close when power flows in one direction, and the other in the reverse direction.

Among the advantages of cross-connected reverse-

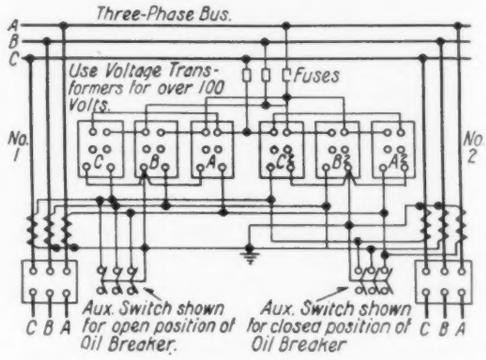


FIG. 2—THREE-PHASE CONNECTIONS WITH AUXILIARY SWITCH ATTACHED TO CIRCUIT BREAKER

power relays are the following: Practically instantaneous action is obtained; they can be set to operate on smaller currents than the full load current of each feeder, and they do not require change of adjustments each time generating systems are cut in or out.

The use of cross-connected relays or double-contact reverse power relays does have some of the disadvantages of balanced systems in that if trouble occurs on the busbars or on all of the feeders simultaneously it cannot be automatically cleared. In addition, some difficulty may be encountered when it is attempted to cut in a new feeder. When the feeders are heavily loaded and an attempt is made to close the switch in the substation end first, the new feeder will be tripped out, whereas if it is closed in the generating end first the feeders carrying the load will be tripped out.

However, the difficulty mentioned may be overcome if the overload elements are given so high a setting that the normal load current cannot possibly operate them. Such a change would, of course, eliminate the advantage

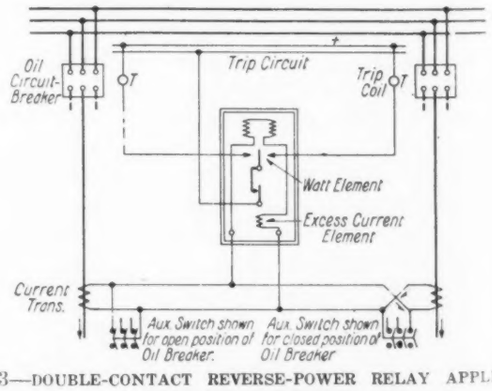


FIG. 3—DOUBLE-CONTACT REVERSE-POWER RELAY APPLIED TO DUPLICATE FEEDERS

that the system can operate on small currents. The possibility of the breaker being tripped out when in a new feeder can be overcome by mechanically or electrically holding the substation relay while "cutting in" first at the substation and then at the generating station.

This scheme has been worked out by engineers of the Westinghouse Electric & Manufacturing Company.

Safety Features in Switching Installations

Interlocking of Disconnecting Switches, Circuit Breakers and Synchronizing Plugs Recommended—Best Locations for Pilot Lamps and Preferred Construction—Weaknesses of Auxiliary Switches and Relays

BY M. M. SAMUELS AND F. N. BECHOFF

JUST a few of the many ideas that can be embodied in electric switching installations to make operation safer for the apparatus as well as the attendants were mentioned in a previous article[1] by the authors of this paper. Some additional points will be emphasized in this article. Among the subjects which will be discussed are the best location for indicating, or pilot, lamps and the construction to be preferred; the possibility and value of interlocking circuit breakers, synchronizing devices and disconnecting switches when the latter are operated by mechanisms instead of by switch hooks; methods of protecting transformers; electrical versus mechanical interlocking of switches which must not be closed simultaneously, and weaknesses of auxiliary switches and relays.

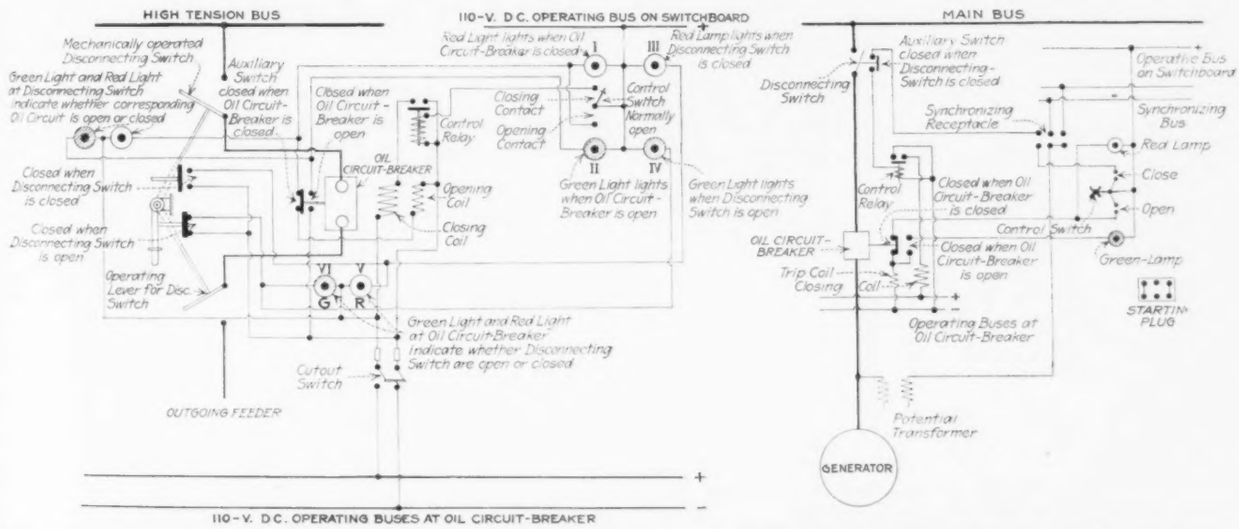
In order to remove as much uncertainty as possible regarding the open or closed condition of oil switches and disconnecting switches when they or their respective circuits must be inspected or repaired, indicating lamps can be permanently placed at the points from which they are controlled and at the switch positions too. This is not impracticable if the disconnecting switches are operated by mechanical devices instead of hook switches and are provided with auxiliary switches to control the indicating lamps.

An arrangement which will suggest how this idea can be carried out is shown in Fig. 1, desirable locations for the pilot lamps being indicated in Fig. 3. This scheme can be employed with outdoor open structures as well as with indoor compartment structures.

It is not advisable to use exposed colored bulbs for the pilot lamps, since they are easily damaged and since an operator when renewing lamps might accidentally place a green bulb in a socket intended for a red bulb and vice versa White bulbs installed in a metal box with red and green lenses in the cover are preferable; the cover should be constructed in such a way that the red and green lenses cannot be interchanged. Details of a box, with lamps and lenses, which fulfills these requirements and allows ample space for the necessary conduit connection and wiring are shown in Figs. 6, 7 and 8. A barrier is provided between the two bulbs so that they can illuminate only their respective lenses. To identify the circuits a name plate can be affixed to the cover.

In addition to providing for the interlocking of oil-circuit-breaker control and synchronizing circuits[2], it is possible, when using mechanically operated disconnecting switches, so to interlock the control circuit with the mechanism of the disconnecting switch that it is impossible to close the oil circuit breaker unless the disconnecting switch has previously been closed. A method of securing this desirable feature is indicated in Fig. 2.

Even if indicating lamps are used, it may happen that an operator, after having adjusted the speed of a generator to secure synchronism, will close the oil circuit breaker, only to discover that the disconnecting switches are still open. If an operator were sent to close the disconnecting switches and he accidentally did so before the other operator reopened the oil cir-


HIGH TENSION BUS
110-V. D.C. OPERATING BUS ON SWITCHBOARD
MAIN BUS
Mechanically operated Disconnecting Switch
Green Light and Red Light at Disconnecting Switch indicate whether corresponding Oil Circuit is open or closed
Auxiliary Switch closed when Oil Circuit-Breaker is closed
Closed when Oil Circuit-Breaker is open
Control Relay
Closing Contact
Opening Contact
Control Switch Normally open
Red Light lights when Oil Circuit-Breaker is closed
Red Lamp lights when Disconnecting Switch is closed
OIL CIRCUIT-BREAKER
Opening Coil
Closing Coil
Closed when Disconnecting Switch is closed
Closed when Disconnecting Switch is open
Green Light lights when Oil Circuit-Breaker is open
Green Light lights when Disconnecting Switch is open
Operating Lever for Disc. Switch
Green Light and Red Light at Oil Circuit-Breaker Indicate whether Disconnecting Switch are open or closed
Cutout Switch
OUTGOING FEEDER
110-V. D.C. OPERATING BUSES AT OIL CIRCUIT-BREAKER
Disconnecting Switch
Auxiliary Switch closed when Disconnecting Switch is closed
Operative Bus on Switchboard
Synchronizing Receptacle
Synchronizing Bus
Red Lamp
Close
Open
Control Relay
Closed when Oil Circuit-Breaker is closed
Control Switch
Green Lamp
OIL CIRCUIT-BREAKER
Trip Coil Closing Coil
Closed when Oil Circuit-Breaker is open
STARTING PLUG
Operating Buses at Oil Circuit-Breaker
Potential Transformer
GENERATOR

FIGS. 1 AND 2—INDICATING LAMPS ON SWITCHBOARD AND AT OIL CIRCUIT BREAKER AND MECHANICALLY OPERATED DISCONNECTING SWITCH THAT PREVENT FAULTY OPERATION; METHOD OF INTERLOCKING CIRCUIT BREAKER CLOSING CIRCUIT WITH SYNCHRONIZING RECEPTACLE AND AUXILIARY SWITCH

The arrangement shown in Fig. 1 is feasible only with disconnecting switches operated by mechanisms; the connections indicated in Fig. 2 prevent the closing of the oil circuit breaker when the disconnecting switch is open.

[1] "Safety Features in Switching Apparatus," by M. M. Samuels and F. N. Bechoff, ELECTRICAL WORLD, Vol. 71, p. 656.

[2] Fig. 5, page 657, ELECTRICAL WORLD, Vol. 71.

cuit breaker, serious damage might result as a generator would then be connected to a bus with which it was not in synchronism.

When disconnecting switches are used as bus-selector switches (Fig. 4) it may happen, when attempting to

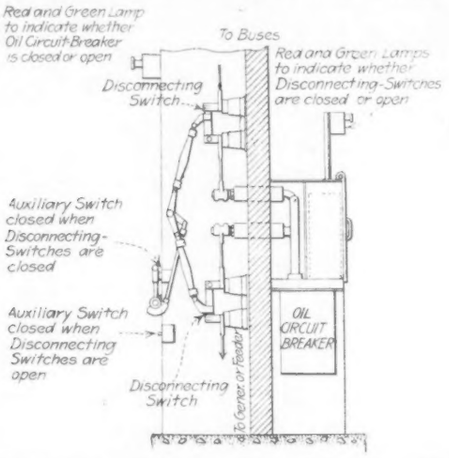
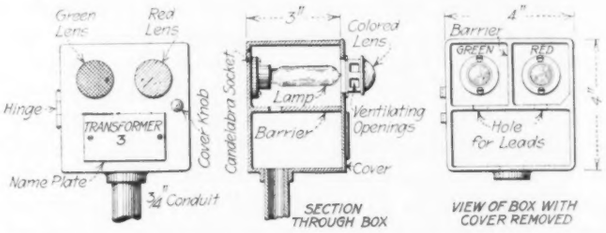

Red and Green Lamp to indicate whether Oil Circuit Breaker is closed or open
To Buses
Red and Green Lamps to indicate whether Disconnecting-Switches are closed or open
Disconnecting Switch
Auxiliary Switch closed when Disconnecting-Switches are closed
Auxiliary Switch closed when Disconnecting Switches are open
OIL CIRCUIT BREAKER
Disconnecting Switch
To Gener. or Feeder

FIG. 3—PROPER LOCATION OF RED AND GREEN INDICATING LAMPS ON SWITCH STRUCTURE. INDICATING LAMPS ARE OPERATED BY AUXILIARY SWITCHES ON OIL CIRCUIT BREAKERS AND MECHANICALLY OPERATED DISCONNECTING SWITCHES

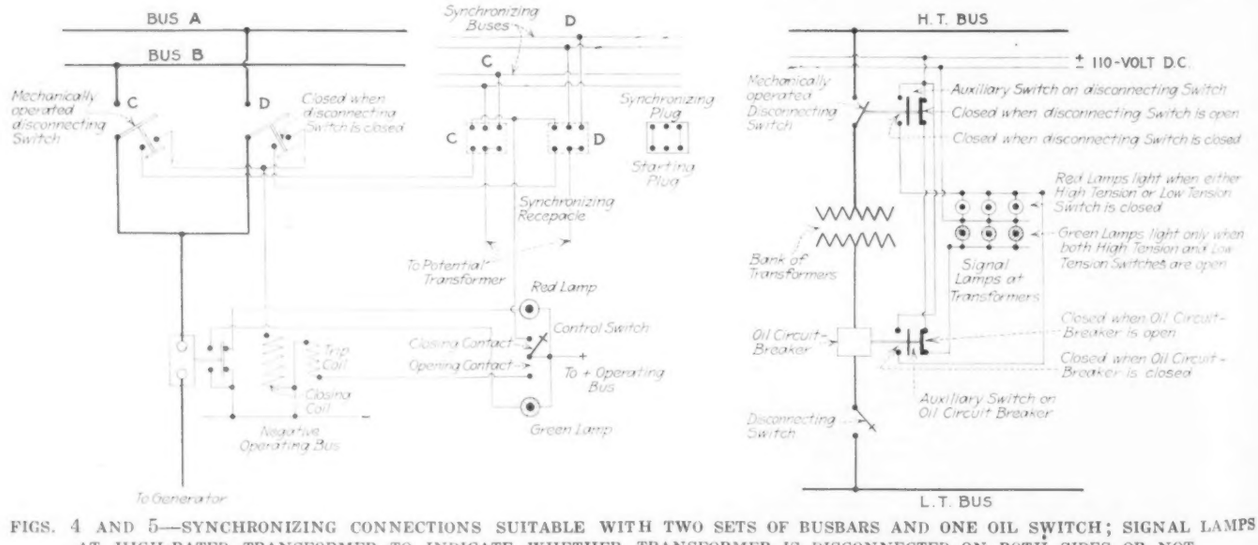
synchronize two systems, that the wrong disconnecting switch will be closed. If this condition exists and the operator closes the oil switch after apparently synchronizing the two circuits he expects to connect, two buses will be connected which may be entirely out of phase. This would not be liable to happen with mechanically operated disconnecting switches having pilot lamps on the board from which the oil switches are controlled. Absolute safety would be assured if the disconnecting switches, circuit breaker and synchronizing plug were

red lamp will indicate when the switch on either the high-tension or the low-tension side of the transformer is closed and that the green lamp will indicate when both the high-tension and low-tension switches are open. This can be accomplished very easily with the connection shown in Fig. 5. The two auxiliary switches controlling the red lamps are connected in multiple, while the two auxiliary switches controlling the green lamps are in series. Where each transformer is installed in a separate compartment it is advisable to provide signal lamps (Fig. 5) outside of the compartment near the door.



FIGS. 6, 7 AND 8—SIGNAL BOX FOR RED AND GREEN INDICATING LAMPS ON SWITCH STRUCTURES; BARRIER PREVENTS ONE LAMP FROM ILLUMINATING BOTH LENSES; UNSYMMETRICAL HINGED COVER PREVENTS INTERCHANGEABILITY OF COLORS

All modern high-rated transformers are now equipped with dial thermometers, which indicate the transformer temperature. Some have a contact to ring a bell alarm when the temperature exceeds a given limit. A second contact may be attached to such thermometers in order to trip the transformer oil circuit breaker when the temperature rises above a certain limit. This is particularly advisable when a transformer is placed far enough from the operator to cause danger of the transformer burning out in the interval of time between re-



FIGS. 4 AND 5—SYNCHRONIZING CONNECTIONS SUITABLE WITH TWO SETS OF BUSBARS AND ONE OIL SWITCH; SIGNAL LAMPS AT HIGH-RATED TRANSFORMER TO INDICATE WHETHER TRANSFORMER IS DISCONNECTED ON BOTH SIDES OR NOT

Interlocking of the synchronizing connections with the auxiliary switches and mechanically operated selector disconnecting switches as shown in Fig. 4 prevents throwing of generator on bus with which it is not in synchronism; all auxiliary switches in Fig. 5 operating red lamps are connected in multiple, whereas the auxiliary switches controlling the green lamps are connected in series.

electrically interlocked so that the circuit breaker could not be closed unless the disconnecting switch corresponding to the position in which the synchronizing plug was placed were closed.

Some liability insurance companies now require that red and green lamps be placed near each transformer of high rating or high voltage and so connected that the

ceiving an alarm and reaching the transformer. Where the transformer is so situated means should also be provided for the operator to trip the circuit breaker from a point near the transformer if an occasion should arise making it necessary. A scheme which will provide such safety features is illustrated in Fig. 9.

Usually water-cooled transformers are equipped with

flow indicators which can be electrically connected with the temperature indicator alarm circuit so that interruption of water circulation will automatically give an alarm. When thermometers are used in connection with transformers they should be so installed that it will not be necessary for an operator to climb a ladder in order to read the temperature. Use of contact-making thermometers will eliminate this objection.

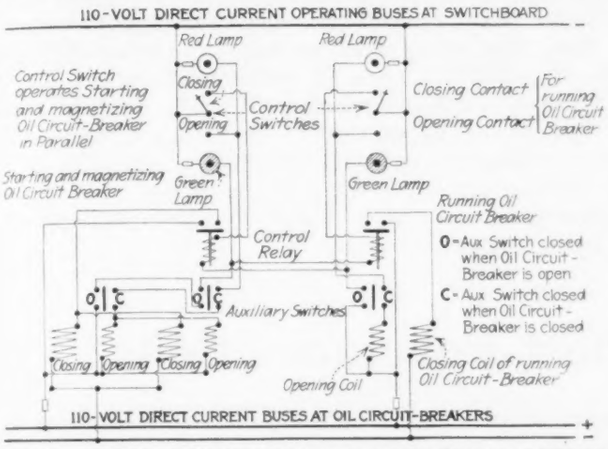
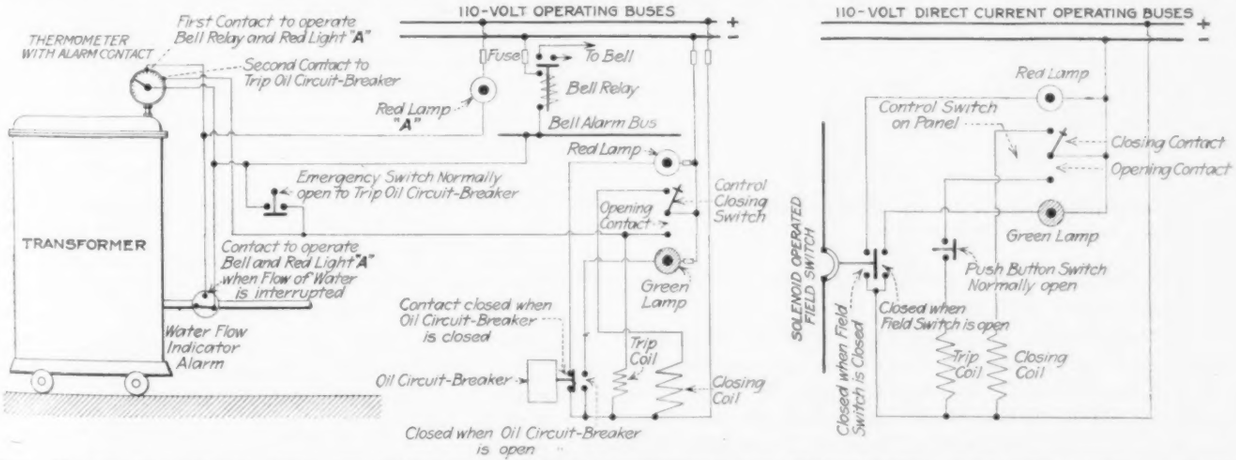


FIG. 9—SYSTEM OF CONNECTIONS FOR INTERLOCKING STARTING, MAGNETIZING AND RUNNING SWITCHES OF LARGE MOTORS; PROPER OPERATION OF INTERLOCKING CONNECTIONS DEPENDS ON RELIABILITY OF AUXILIARY SWITCHES

Up to the present time, so far as the authors know, there has not been developed an auxiliary switch for oil circuit breakers and other apparatus which is adequate for all purposes. Considering the fact that the operation of nearly all safety devices in power houses and substations depends chiefly on the proper and reliable operation of auxiliary switches, it is obvious that even with modern indicating and automatic safety devices there cannot be a high degree of safety unless a standardized, practically infallible auxiliary switch is developed. Auxiliary switches which may have been perfectly satisfactory for apparatus used in the past are not at all adequate for modern circuit breakers because their rupturing capacities and velocities of operation have both been increased. All auxiliary switches should be easily accessible for connection, inspection and repair. Owing to unreliability of auxiliary switches known to the authors, it is sometimes necessary to use multiple contacts, but this precaution does not always prevent auxiliary switch trouble. Usually there is an auxiliary switch in the tripping circuit of each circuit breaker, and if this switch fails the circuit breaker will fail to open when overloaded or short-circuited, thus causing considerable damage to the transformers and other apparatus connected therewith.

The interlocking of circuit breakers to prevent the simultaneous closing of two or more of them where such simultaneous closing would be dangerous is usually accomplished by auxiliary switches. For instance, when large motors are started by means of a compensator a magnetizing switch, a starting switch and a running switch are provided. It is important that the control circuits of these three switches be interlocked so that the running switch cannot be thrown in until the motor is brought to speed by the magnetizing and starting switches. It is of even greater importance not to have the starting and running switches both closed at the same time, since under this condition the compensator would burn out. Interlocking to prevent such trouble may be accomplished with hand-operated switches by mechanical means, but with electrically operated oil circuit breakers it is necessary to interlock the control circuits electrically by means of auxiliary switches unless the control switches are mechanically interlocked. Although interlocking of the control circuits gives a more flexible arrangement, it cannot be considered the safest method unless a thoroughly reliable auxiliary switch is employed. The conections for electrically interlocking oil circuit breakers used in starting either synchronous or induction motors are shown in Fig. 10.

What applies to auxiliary switches is likewise true of relay contacts. Although progress has been made in the design of various types of relays, their contacts should be further improved, since the majority of modern relay contacts are unable to carry the current required to trip large circuit breakers. Often it becomes necessary to resort to auxiliary relays, which are only an additional evil, because the size of nearly all relays is restricted by the secondary ampere rating of the current transformers, which generally does not exceed 5 amp. White 5-amp. secondaries are sufficient on cur-



FIGS. 10 AND 11—TEMPERATURE AND WATER-FLOW ALARM CONNECTIONS FOR TRANSFORMER; FOUR-WIRE CONTROL CIRCUIT FOR OIL SWITCHES

An additional contact is provided on the transformer temperature alarm for tripping the circuit breakers at excessive temperatures; an emergency tripping switch is also provided at the transformer. In Fig. 11 the push-button is in the opening side of the control circuit.

rent transformers for use with meters and also for operating automatic devices on circuits of low capacity, they are hardly suitable for oil circuit breakers of high rupturing capacity. Therefore it is suggested that the secondary rating of current transformers for such protective purposes be increased. When this is done it will be possible to develop relays with contacts of adequate size. While the same current transformer is suitable for both the meters and relays in small installations, two separate sets of current transformers are advisable in large installations: One set should be used for the meters and the other for automatic relay protection. With this arrangement it is obvious that an increase in the rating of the secondaries of the relay current transformers would not destroy the accuracy of the meter reading, a consideration of importance.

It is still customary to install all relays on the switchboard, this arrangement being necessary because the present relays require constant attention and frequent inspection and adjustment. With current transformers having a higher secondary rating it will be possible to design relays of large sizes and more rugged construction. Such relays would not have to be mounted on the switchboard but could be placed near the oil circuit breakers or other apparatus which they are to protect, thus eliminating unnecessary conduits and wiring and minimizing the switchboard space necessary.

In conclusion, provisions should be made for disconnecting control devices from the control bus to permit repairing and inspection.

Self-Inductance of Short Reactance Coils

Formulas Which Can Be Applied with Accurate Results to Calculate Self-Inductance of Thick Coils—Curves Based Upon These Formulas and Methods of Using the Information That Is Thus Derived

BY H. B. DWIGHT, CANADIAN WESTINGHOUSE COMPANY

IN CALCULATING the self-inductance of commercial reactance coils it is useful to have formulas which make special allowance for the thickness of the winding, which is considerable in usual types of coils, such as current-limiting reactors, paralleling coils for transformers and the coils used with reactance-type circuit breakers. In this article formulas are given for coils whose length is shorter than their mean diameter. These formulas are similar to those for long thick coils which were recently published in the ELECTRICAL WORLD[1] and with them cover the complete range of circular coils.

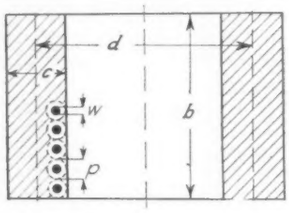


FIG. 1—SHORT THICK COIL ON WHICH CONCLUSIONS ARE BASED

The formulas for self-inductance of short coils are derived from an expression for the mutual inductance of two coaxial circles. This was given in the form of a convergent series by Maxwell,[2] and the series has been extended by E. B. Rosa and L. Cohen.[3] More recently, a further extension has been made by T. R. Lyle,[4] who has used the series to obtain a formula for the self-inductance of a short thick circular coil by means of a method involving Taylor's theorem.

The same formula for thick coils, to the fourth power of the dimensions, has been derived by the writer by two other independent methods, and thus a check has been made on the accuracy of the terms up to and including the fourth power. By the first of these methods the series for the mutual inductance of two circles was integrated to give the mutual inductance of two coaxial and concentric thin solenoids of equal length. This expression was then integrated over the section of the thick coil indicated in Fig. 1, giving the formula for the self-inductance of the coil. The other method, which gave the same result, consisted in integrating the series for two circles so as to give the mutual inductance of two equal thin disks on the same axis. Then this expression was integrated over the section of the coil to give its self-inductance.

The above-mentioned self-inductance formula is very suitable for precision calculations, especially when the terms of the sixth power are included. These were worked out by Dr. Lyle and published in an appendix to his article referred to above. But the formula is extremely long for engineering work, and it can be considerably simplified by expanding some of the terms, such as $\log h\, x$ and $\tan^{-1} x$, into series. Good accuracy is obtained for thick coils whose length is as great as their diameter by keeping all terms up to and including the fourth power of the dimensions.

For short coils, in which the length b (Fig. 1) is less than the mean diameter d but greater than the thickness c, the precision formula can be expanded in terms of c/b as follows:

L, in henries =

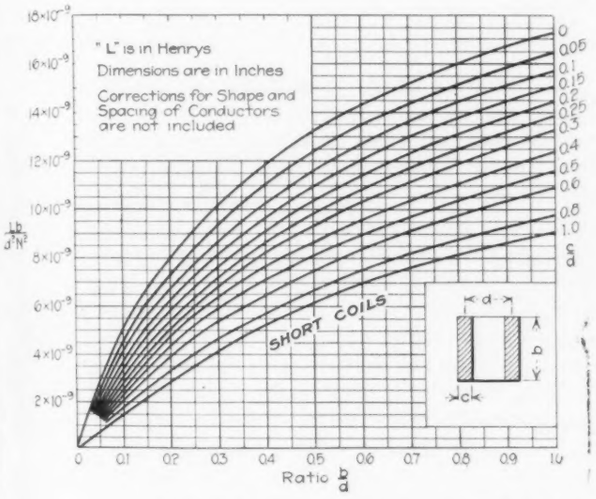
$$\frac{2\pi dN^2}{0.3937\times 10^9}\left[\left\{\log h\,\frac{4d}{b}\right\}\left\{1+\frac{1b^2}{8d^2}+\frac{1c^2}{24d^2}-\frac{1}{64}\left(\frac{b^4}{d^4}-\frac{7b^2c^2}{6d^4}-\frac{11c^4}{45d^4}\right)\right\}+\frac{1c^2}{6b^2}\left(\log h\,\frac{b}{c}\right)\left(1-\frac{1c^2}{20d^2}\right)-\frac{1}{2}-\frac{\pi c}{3b}+\frac{1c^2}{8d^2}+\frac{1b^2}{32d^2}+\frac{25c^2}{72b^2}+\frac{1}{96}\left(\frac{b^4}{d^4}-\frac{19b^2c^2}{8d^4}+\frac{8c^4}{15b^4}-\frac{67c^4}{75b^2d^2}+\frac{17c^4}{40d^4}\right)+\frac{1}{qN}\left(\log h\,\frac{p}{w}+0.14\right)\right] \quad (1)$$

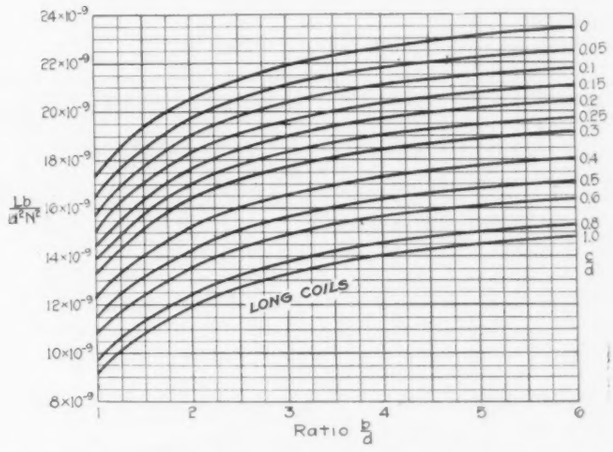
[1] "The Self-Inductance of Long Reactance Coils," by H. B. Dwight, ELECTRICAL WORLD, Feb. 9, 1918, p. 300.
[2] "Electricity and Magnetism," Vol. II, para. 705.
[3] "*Bulletin of the Bureau of Standards*, Vol. 2, 1906, No. 3, page 366.
[4] *Philosophical Transactions of the Royal Society of London*, Vol. 213, 1913, page 421.

For flat coils, in which the axial length b is less than c, the expansion can be carried out in terms of b/c, as follows:

L, in henries =

$$\frac{2\pi dN^2}{0.3937\times 10^9}\left[\left\{\log\text{h}\ \frac{4d}{c}\right\}\left\{1+\frac{1b^2}{8a^2}+\frac{1c^2}{24d^2}-\frac{1}{64}\left(\frac{b^4}{a^4}-\frac{7b^2c^2}{6a^4}-\frac{11c^4}{45a^4}\right)\right\}+\frac{1b^2}{6c^2}\left(\log\text{h}\ \frac{c}{b}\right)\left(1+\frac{1b^2}{4d^2}+\frac{1b^2c^2}{4a^4}\right)-\frac{\pi b}{3c}\left(1+\frac{1b^2}{5d^2}+\frac{1b^2c^2}{15d^4}-\frac{2b^4}{35d^4}\right)-\frac{1}{2}+\frac{1b^2}{8d^2}+\frac{25b^2}{12c^2}+\frac{43c^2}{288d^2}+\frac{1}{96}\left(\frac{16c^4}{25d^4}-\frac{1b^2c^2}{24d^4}+\frac{8b^4}{15c^4}+\frac{23b^4}{3c^2a^2}+\frac{31b^4}{24d^4}\right)+\frac{1}{qN}\left(\log\text{h}\ \frac{p}{w}+0.14\right)\right] \qquad (2)$$


"L" is in Henrys
Dimensions are in Inches
Corrections for Shape and Spacing of Conductors are not included
SHORT COILS
Ratio b/d



FIGS. 2 AND 3—CURVES FOR DETERMINATION OF THE SELF-INDUCTANCE OF REACTANCE COILS

For coils of square section, in which b is equal to c, the formula becomes

L, in henries =

$$\frac{2\pi dN^2}{0.3937\times 10^9}\left[\left\{\log\text{h}\ \frac{4d}{c}\right\}\left\{1+\frac{1c^2}{6d^2}+\frac{37c^4}{5760d^4}\right\}-1.1949133+0.146293\ \frac{c^2}{d^2}-0.010860\ \frac{c^4}{d^4}+\frac{1}{qN}\left(\log\text{h}\ \frac{p}{w}+0.14\right)\right] \qquad (3)$$

For this case formulas (1) and (2) will also solve the problem. Therefore formulas (1) and (2) are sufficient for calculating with ordinary accuracy the self-inductance of thin or thick cylindrical coils whose axial length is shorter than their mean diameter.

The self-inductance of both long and short reactance coils is plotted in Figs. 2 and 3, which are curves for coils of various thicknesses. These can be used for obtaining approximate values of inductance and for making a check on calculations. However, more accurate values will often be required that can be obtained from the curves, and direct calculation by the formulas will be necessary.

Problem I.—To find the self-inductance of a coil wound with 1000 turns of round wire in ten layers of 100 turns each. The diameter of the insulated wire is $p = 0.1$ cm. and the diameter of the bare wire is $w = 0.08$ cm. The mean diameter of the coil is $d = 10$ cm., the length is $b = 10$ cm., and the thickness is $c = 1$ cm.

The self-inductance L_s of a thin coil of diameter $d = 10$ cm. is given by formula (1) by omitting the terms in c and the last bracket.

Thus,

$$L_s = (2\pi\times 10\times 10^9)/10^9[1.386(1+0.125-0.0156)-0.5+0.0312+0.0104] = (\pi/100)\times 2.159 \text{ henries.}$$

The other terms of formula (1) are

$$(2\pi/100)[1.386(0.00042+0.00018)+0.0038-0.1047+0.00125+0.0035-0.0002+0.00036] = -(\pi/100)\times 0.190.$$

Therefore the self-inductance of the coil is

$$(\pi/100)\times 1.969 = 0.06185 \text{ henry.}$$

The self-inductance of the same coil, calculated by the engineering formula for long thick coils, is 0.06194 henry.

Problem II.—To find the self-inductance of a coil of mean diameter $d = 10$ in. (25.4 cm.), of axial length $b = 2$ in. (5.08 cm.) and of thickness of winding $c = 2$ in. (5.08 cm.). It is wound with 400 turns of square wire with very thin insulation.

By formula (1),

$$L = \frac{2\pi\times 10\times 160{,}000}{0.3937\times 10^9}[2.996(1+0.005+0.0017)-0.5-1.0472+0.005+0.00125+0.3472+0.0052] = 0.04666 \text{ henry.}$$

By formula (2),

$$L = \frac{2\pi\times 10\times 160{,}000}{0.3937\times 10^9}[2.996(1+0.005+0.0017)-1.0556-0.5+0.005+0.3472+0.0060+0.0088] = 0.04666 \text{ henry.}$$

By formula (3), $L = 0.04664$ henry.

National Research Council to Be Permanent

By order of President Wilson, the National Research Council, which was organized in 1916 at his request by the National Academy of Sciences, as a measure of national preparedness, is to be perpetuated. Representatives of the government will, upon the nomination of the academy, be designated by the President as heretofore as members of the council.

Burning Dust-Bearing Coal

Results of Tests to Determine Its Air Admittance, with Conclusions as to How This Fuel Can Be Burned Efficiently—Better Control of Boiler Plant, with Increased Reliability and Flexibleness, Attained

BY L. A. STENGER

CONSIDERATION of the fundamental laws of coal combustion and conditions affecting boiler and furnace performance led the writer to study the air flow through coals. Several interesting observations were made which have a direct bearing on the important question of fuel conservation in this country. Preliminary tests showed that the weight of air passing

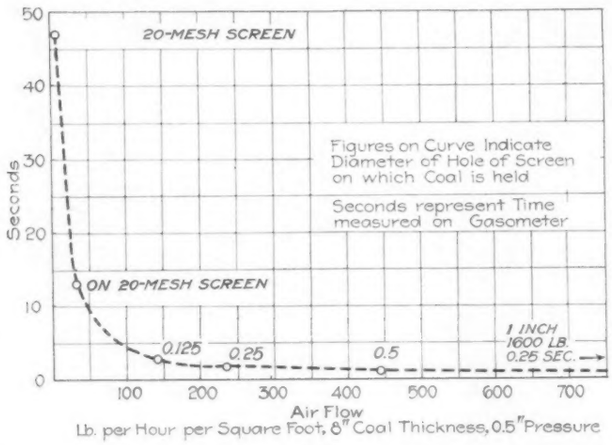


FIG. 1—RATE OF AIR FLOW THROUGH SCREEN-GRADED COALS

through a given coal per unit of time is dependent upon the difference in air pressure through the bed, thickness and area of the bed, state of surface wetness of the coal, and most important, the degree of fineness of the coal particles. These tests were made with a simple apparatus like a gasometer, which would deliver a volume of air at constant pressure through a cup with screened bottom, which contained the coal under test. The time taken to force the known volume of air through the coal was measured with a stop watch. This furnished data to compute unit air flow.

Different coals of various screen gradings, dust contents, conditions of surface wetness, etc., were tested under comparative conditions. Tests comparing surface, dry, dust-bearing coal with the same coal when the surface was wetted throughout the mass showed that the wet coal allowed approximately twice the air flow that the dry coal would. This is due to the fact that the water collects the small grains, holding them together and to the larger pieces, thus preventing their settling and filling the void spaces. After the coal is again dried, if it is not agitated too much, the dust is cemented together loosely by the deposited soluble salts of the coal. The resulting increase of air flow explains the improvement in combustion of wetted coal. It was also proved that layers of dust, placed either at the top, bottom or in an intermediate position in the coal mass, retarded the air flow to a much greater extent than if the dust were distributed uniformly throughout the coal.

The comparative rates of air flow through screen-graded coals are indicated in Fig. 1. This indicates that air flow was sharply restricted by grain sizes near ⅛-in, (3.175 mm.) and increased at very rapid rates as the grains were larger. That part of coal near ⅛-in. grain size and less is designated as dust. The extent to which dust in the coal affects the air flow is shown by Fig. 2. This curve represents the average of air-flow tests on different surface wet coals as received ready for firing.

RELATION OF AIR ADMITTANCE TO BOILER PERFORMANCE

The relation of air "admittance" of coals to steam-boiler performance is shown in Fig. 3, which gives results obtained from systematic measurements on air flow plotted against data from evaporation tests, with chain grates serving 556 hp. B. & W. boilers. Each of these tests was made with care and attention to details so as to get the best attainable boiler capacity and efficiency. The duration of the tests was from eight to nine hours each. Slack and screenings were used, the largest pieces being not over 1½-in. (3.81-cm.) in size, usually having wet surfaces as fired and varying in dust content. Some of the tests were made with coal screened approximately dust-free to compare the performance of the coarse fraction with a dust-bearing coal of the same kind. This was done with both Illinois and Youghiogheny screenings. The B.t.u. value of each of the coals as fired was placed on the chart to show its small comparative influence on boiler performance. A dust-free 9900 B.t.u. coal gave much better results than a dust-bearing 12,000 B.t.u. coal.

It should be understood that the figures representing

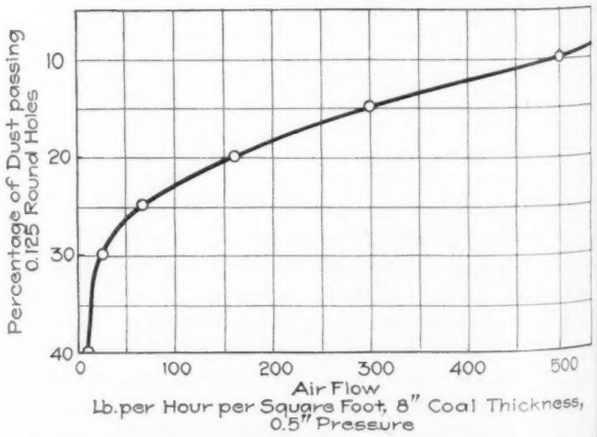
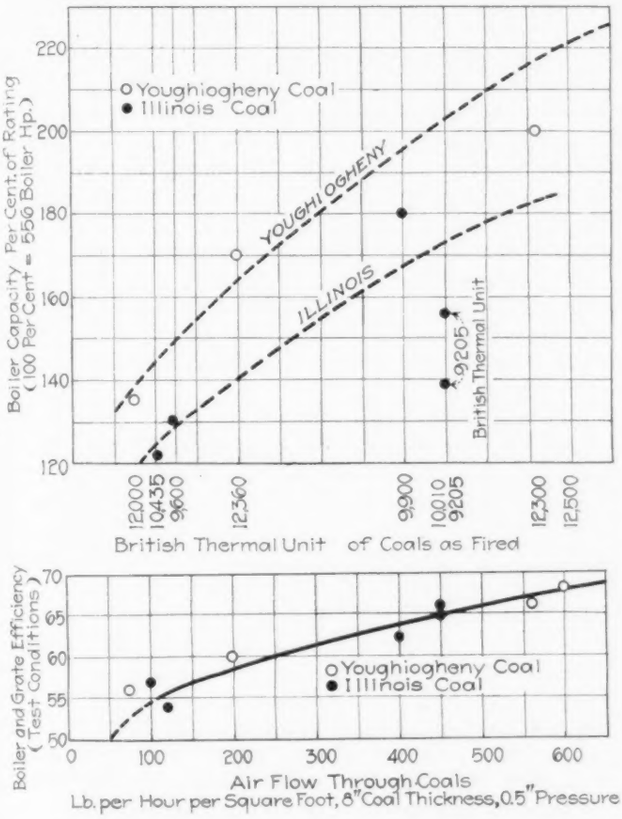


FIG. 2—RATE OF AIR FLOW THROUGH COALS HAVING DIFFERENT DUST CONTENTS

air flow through cold coal before firing it are no index to the amount of air flowing through the burning fuel bed, but they do show that a coal having limited air admittance cannot be burned efficiently as ordinarily fired and that there is an important relation between that property of fuels and boiler and furnace performance.

Losses in efficiency due to dust in coal are traced to the difficulty in maintaining a free-burning, uniform fuel bed. Holes, ridges or streaks will form. Air passing through holes and areas of burned-out ash causes augmented chimney losses. Areas of coal impermeable to air lie inert, are only coked, not burned, and finally contribute to losses in the ash pit. Boiler capacity is limited, owing to low efficiencies and to reduced rates of combustion.

A study of the data presented herewith and other experiences with dust-bearing coals on different types of stokers, including forced-draft stokers and hand-fired furnaces, shows that it is impossible to attain as good results as may be had from dust-free coals of lesser B.t.u. values. There is not much hope that the operating boiler efficiencies ordinarily obtained in large



FIGS. 3 AND 4—RELATION OF MEASURED AIR FLOW TO BOILER PERFORMANCE

plants can be raised and maintained at any desirable standard if dust-bearing coals are burned with ordinary furnace equipment. To add to the trouble fuel is becoming poorer in all respects and more expensive. Limitation of boiler capacity also contributes to low plant efficiency. This leads to higher costs, both of boiler-house equipment and of operation. Although good types of forced-draft stokers with the ability to increase steam output to 250 or 300 per cent of boiler rating aid much in this regard, their operating efficiency is lowered by dust-bearing fuels.*

*The "operating boiler efficiency" $e = (100 - a) \times b \times c \times 10^{-4}$, where a = the more or less indeterminate losses of the plant, from banking fires, leaks, etc. a varies inversely with the load factor and may be from 5 to 20 in value; b is the operating boiler efficiency, and c is the thermal efficiency of prime movers, including auxiliaries; e is known from 3420 ÷ B.t.u. per kw.-hr. The operating boiler efficiency will always be less than the average boiler and grate efficiency determined from evaporation tests on the same type of fuels used in the plant, and it depends on conditions of fuel, labor and boiler-plant control.

A plan for permanently raising operating boiler efficiency and the boiler capacity of a steam-power plant follows: Crush all coal, if necessary, so the largest lumps will not be over 1 in. (2.54 cm.) in size. Screen on a mesh chosen to remove all dust of ⅛-in. (3.175-mm.) size and less. Dry and pulverize the dust and burn in pulverized coal-burning furnaces serving a part of the present boiler installation. The coarse coal may be burned in the remaining furnaces, in which no changes have been made.

The data in the table give comparative estimates on the plan, based on these assumptions: 9600 B.t.u. and 13 per cent moisture in coal as bought; 25 per cent of the dust is screened from coal (dust having 8600 B.t.u. and 15 per cent moisture or 10,000 B.t.u. and 1 per cent moisture as fired); 40 cents per ton of dry dust is the approximate cost of screening all coal and drying and pulverizing the dust, or 9 cents per ton of coal bought. These costs are based on present prices of a pulverizing plant of about 75 tons daily output and include all the usual fixed and operating charges. It may be noted that the operating boiler efficiency and some other figures set forth for the suggested plan are weighted averages.

COMPARATIVE DATA ON PLAN DESIGNED TO BRING ABOUT INCREASE OF BOILER EFFICIENCY

	Present Operation	With Suggested Plan		Plant Average
		Coarse Coal	Pulverized Coal	
Operating boiler efficiency (per cent)	55	72	76	73
Calorific value of coal as fired (B.t.u.)	9600	9900	10,000	9922
Lb. coal as fired per 1000 lb. water evaporated	184	....	....	134
Lb. coal as bought per 1000 lb. water evaporated	....	....	....	139
Lb. coal as required per 1000 lb. water evaporated (includes coal for drying dust), total	184	....	....	140
Lb. coal saved	....	....	....	44
Coal saved (per cent)	....	....	....	24
Added cost of coal per ton bought due to treatment	....	....	....	$0.09
Net financial saving (per cent) with coal costing:				
$1 per ton at plant	....	....	....	13.2
$2 per ton at plant	....	....	....	19.7
$3 per ton at plant	....	....	....	21.2
Approximate increase in boiler rating, from 125 to 175 per cent of rating (per cent)	....	....	....	40.0

It may be seen that the net saving is based upon the possible increase in boiler operating efficiency only. A further saving is possible in plants with the usual load factor of lighting and power plants by bringing about a decrease of the quantity a in the plant efficiency formula given in the footnote. This saving was not estimated on account of the indefiniteness of the figures involved. It would be no inconsiderable economy, owing to less banking of fires, as a smaller number of boilers would have to be fired to carry the peak load than under the conditions previously existing.

With the suggested plan in operation the boiler plant could be better controlled and it would be more flexible and more reliable. There would be much less ash to dispose of. The savings brought about in money, coal and transportation and the inexpensive increase of power capacity as compared with the previous output would be very helpful at any time, and most of all in the immediate future, when the problem of war-time economy looms so large.

Experiment in Insurance Co-operation

More than One Hundred Electric and Gas Companies in New York State Unite to Protect Themselves Against Claims for Accident Compensation—Experience Shows Excellent Results from Plan Adopted

BY CHARLES E. MORRISON, C.E.
General Manager Utilities Mutual Insurance Company

PRIOR to July 1, 1914, when the workmen's compensation act became effective in New York State, the public utility interests, as represented by both the electric and gas industries, conceived the idea of forming some sort of a mutual organization for the purpose of taking care of their needs in respect to compensation insurance, particularly with the thought that by so doing they might practically demonstrate the advantages of co-operation in connection with this detail of their business. This included, naturally, not only the payment of claims for accidents incurred but also its corollary, "accident prevention."

As a result of this thought on the part of the public utility operators, the Utilities Mutual Insurance Company was organized with approximately 100 electric and gas companies constituting its membership.

The scheme was to conduct the operations on a purely businesslike basis, and in effect the organization was, as its name indicates, a truly mutual compensation insurance company, confining its activities, however, exclusively to this form of insurance and to New York public utilities. Numerous advantages were to be derived by thus restricting it to preferred classified risks.

To every member company the same premium was charged that would be charged by a tariff or stock compensation insurance company, and then, after having set up appropriate and adequate reserves for losses that had been incurred through accidents, as well as charging against operations all necessary expense, the undivided surplus was to be distributed among the member companies as a dividend, thus operating to reduce the net cost to the members themselves.

So far as is known, this is one of the first practical demonstrations in the utilities field of companies getting together for the purpose of reducing operating expenses by a mutual or co-operative organization.

There are, of course, many national, state and local scientific, commercial and other bodies in the industry which generally seek to assist one another by the exchange of technical, commercial or other ideas, data and information; but perhaps it remained for the Utilities Mutual to demonstrate conclusively that it was as feasible to pool the interests of the industry for the purpose of securing the financial returns from co-operative action as along other lines.

Business Success of the Undertaking

As one looks back on the organization as first constituted, it seems as though it were a very foolhardy undertaking for a group of public utility operators to originate an insurance company with practically no knowledge of insurance matters, but it remains to be said nevertheless that these operators, through the application of business methods, have made their undertaking a very profitable one.

In no year has the company returned less than 20 per cent in the form of dividends, and its surplus has always substantially exceeded this amount. In effect, this means that by the application of business methods to the detail of compensation insurance for public utilities we are able to cut the cost materially below that of the stock or tariff companise. A question naturally arises as to how these results have been accomplished.

Chief Factors in Success

We say, without fear of contradiction, that perhaps the largest contributors to this success are the 100 per cent moral hazard, the mutual interest and the co-operative spirit that naturally exist among public utility operators as a class. This spirit, as a result of the elimination of competition, may unquestionably be more intensively developed among them than in any other single industry, and as a consequence the insurance carrier—which is in effect the member companies themselves—has reaped the benefits in that safety first suggestions have been uniformly and willingly complied with by the operator and accidents correspondingly decreased.

The recommendations offered to our member companies deal primarily with the physical hazards existing in their plants and are the result of the most careful engineering inspections. It is wise to note here, however, that there is a very marked difference between our engineering inspections and those of other companies or organizations. It rests primarily on the fact that we believe more can be accomplished by a sincerity of purpose than by an arbitrary attitude that this or that may be wrong and therefore *must* be corrected. Our engineers are known personally to the staff of each member company as responsible, painstaking men, and they always get a cordial reception when they undertake an inspection. It is because they get close to the operatives that an interest is created in their work and their recommendations and that, as a sequence, the reduction in the number of accidents has taken place.

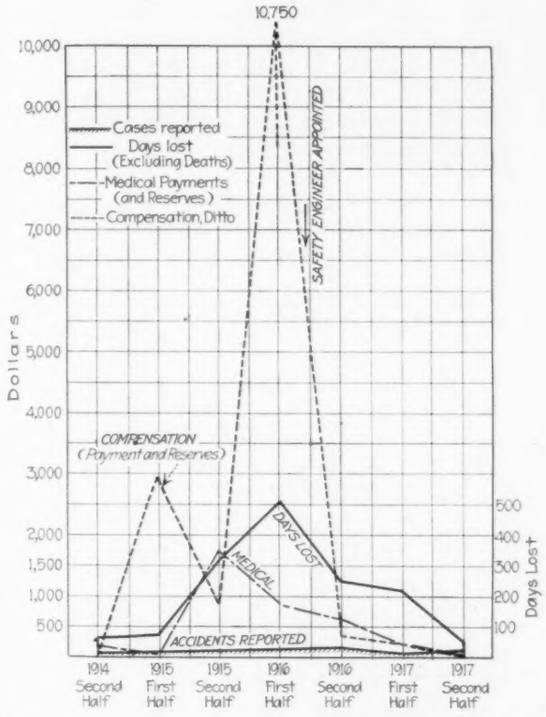
We endeavor to make at least two examinations of each company's property in each year—the same engineer never making two successive inspections. This enables us to place a check on the observation powers of each inspector and to create a friendly rivalry among them. As soon as these inspections are made the home office is advised, and a communication with a report is sent to the manager of the member company requesting him to inform the home office as to what action will be taken with respect to these recommendations. Invariably the reply is that they will be complied with immediately or as soon as the material and labor can be supplied for the purpose.

While these recommendations deal largely with the removal of physical hazards or defects and the installation of safety devices, they act also as a stimulus to further effort on the part of the employees and

the management. They also apply to housekeeping conditions the morale and esprit de corps of the employees. Careful supervision is kept of these recommendations through a follow-up system, to see that eventually all are complied with.

The inspections are quite frequently followed by safety first talks and committee meetings, together with illustrated moving pictures on standard safety first practice. We endeavor to see that all of our member companies are supplied with the invaluable bulletins of the National Safety Council, as these always have some vital message to tell.

Accident statistics are kept of each member company, so that at any time it is possible to develop each company's experience for the purpose of correcting unsafe practices. This develops a comparison of each member company's experience with that of the average of all, and if the experience of the individual is less satisfactory than that of the group as a whole, there is immediately created an incentive on the part of the operator or general manager to better this record in order to present as clean a slate as that of others to whom he is personally known. Should an abnormal record develop with respect to any one particular company, a conference is arranged with the general manager for the purpose of discussing in detail his safety first work or lack of safety first work.



HOW A UTILITY COMPANY'S ACCIDENT COSTS DECREASED WITH APPOINTMENT OF A SAFETY ENGINEER

Frequently an inspector will be assigned for an intensive investigation of two or three weeks to one of these member companies for the purpose of studying the underlying spirit of the organization and to determine whether there is not some element or factor which is tending to cause carelessness on the part of employees and therefore to promote accidents. Sometimes also the safety engineer of one organization will be loaned to another in the interests of "safety first."

That these inspections have produced results is demonstrated beyond question by the record of fatalities which in the electric industry contribute most largely to the losses. The following will serve for an example: Among approximately 5000 employees with an annual payroll of about $5,000,000 the six months ended June 30, 1917, contributed just one fatal accident.

Even in this case it is questionable if the accident was a result of operating conditions, as it is felt, and we believe proved, that the employee died from natural causes. This one fatality compares with six fatal accidents occurring in the preceding six months. While it is appreciated that there may be a considerable element of chance or luck in this, there are good grounds for believing that the more intensive inspection service in the later period contributed very largely to this reduction of fatal accidents.

Accident Reduction as a Business Proposition

One particular reason why our member companies are so willing to co-operate for the protection of their employees—aside from the purely humanitarian one—is that they can readily see how their personal interests are being served by the reduction of accidents at their respective plants. Every life that is saved, every accident that is prevented, means so much less in the cost to the company as a whole, and therefore so much more surplus to be divided among the individual member companies in proportion to the premiums that they pay.

On a purely dollars-and-cents basis this co-operative spirit has returned to the public utilities of the State in the past three years a sum in excess of $100,000. Such an amount is not to be belittled in these times of increasing production costs, and we know of no other department in public utility operations that compares with this return.

There is submitted with this article a curve which indicates what may be expected to happen when the safety first and accident prevention problems are attacked in a consistent and intelligent manner.

This curve represents the experience of a public utility company in the State of New York. It will be noticed that to the left of the peak the compensation costs, medical costs and days lost, which latter do not include fatalities, are very irregular and excessive. The peak represents several serious accidents, and at this time it was deemed advisable to secure the services of a safety engineer. A glance at the curve to the right of the peak will show how the compensation costs, medical costs and days lost have consistently fallen.

Perhaps immediately after the several serious accidents was the strategic time to prepare intensively against similar occurrences, and perhaps also eighteen months may not legitimately be considered as conclusive evidence of accident experience. However this may be, nevertheless we do know from the curve that less money has been spent for compensation, less money has been spent for medical attention, and fewer days of lost time have been recorded, since the installation of the safety engineer than before it. No further evidence, it is believed, is necessary to indicate the vital need of attention to careful and safe practices among employees nor to prove how enormously it may contribute to accident reduction.

Economic Aspects of Summer Load—I

Features of a Class of Service Which, When Properly Handled, Yields Profitable Revenue and Exerts Great Influence in the Popularization of Electricity—How Power Business Grows in the Hot-Weather Term

THE economic value of summer service by central stations is of widespread interest to managers of companies whose systems are within commercial reach of vacation resorts. A comparatively high rate per kilowatt-hour is often applied to this class of service

FIG. 1—NEWPORT "COTTAGE"; SUMMER REVENUE TO CENTRAL STATION FROM THIS MANSION HAS EXCEEDED $600 A MONTH

on account of the few months during which it is in demand and the resulting relatively large overhead charges associated with the distribution of energy to customers of transient or semi-permanent character.

It is doubtful if any general statement can be made that summer service is unfailingly profitable to central stations, so much depends upon the intelligence with which it is provided and maintained. In a recent study of summer service among central stations made by a representative of the ELECTRICAL WORLD, it was found that very few analyses have been made by managers of the investment and operating costs of this class of busi-

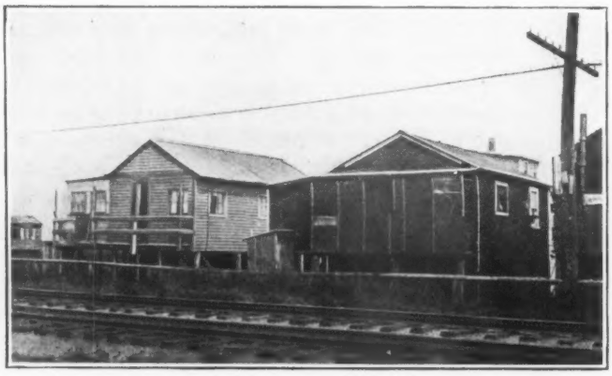


FIG. 2—SUMMER HOMES AT REVERE BEACH, MASS.; WITH THESE HOMES INVESTMENT MUST BE KEPT AT MINIMUM

ness. Data as to revenue are much more accessible. The entrance of the United States into the war has left central-station managers little time in many cases in which to analyze the summer load, and the policy of extreme conservatism regarding extensions has held back development on many properties. None the less, from an extended survey of the summer-load field, it appears clear that if this business is to be handled profitably, certain points must be considered, and in the following paragraphs some of these will be discussed.

An extraordinary range of revenue yield is found in summer service. The multi-millionaire's "cottage" at Newport, R. I. (Fig. 1), has yielded over $600 per month to the local central station in the height of the summer entertaining season. The humble cabin at Revere Beach, Mass. (Fig. 2), brings the lighting company perhaps $4 to $5 for the entire season from May to Labor Day. Between such limits as these are returns of the most varied character, and the "acid test" of profit or loss depends for its outcome upon service cost in its broadest aspects, including a careful control by the central station of the investment required.

Where a large seasonal revenue is obtained it naturally follows that a much greater outlay for distributing lines can be carried successfully than where

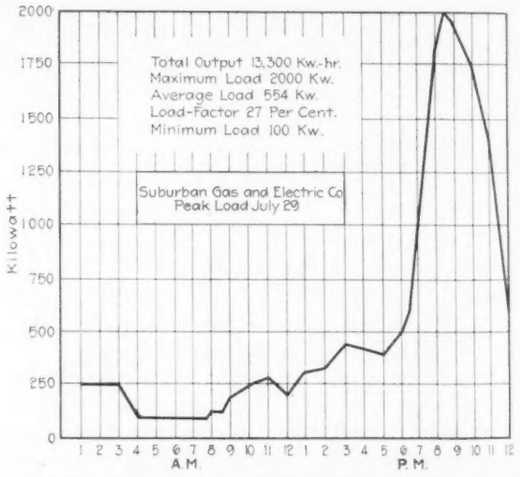
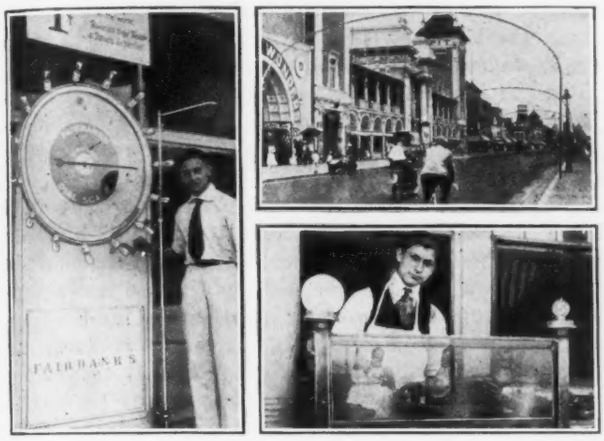


FIG. 3—LOAD CURVE OF COMPANY SERVING REVERE BEACH ON THE DAY OF MAXIMUM SUMMER PEAK

the income yield of a customer is nominal. Fine establishments such as one sees at Newport, Bar Harbor, York Harbor, Me., and other high-class vacation resorts justify underground service entrances almost invariably. Customers occupying these costly estates often insist on the absence of all pole-line construction in the immediate vicinity of their residences.

On the other hand, the types of summer homes shown in Fig. 2 must be served at rock-bottom investment cost, and in the case shown in the photograph this has been accomplished by carrying the secondary mains past the cottages and feeding the latter in pairs off two-wire drops. The individual cottage leads are connected with the drop lead by ordinary overhead soldered joints, without extra insulating equipment or structural installation beyond the house attachments. The service is carried downward from the outside insulators to the entrance near the meter location by a short vertical run of iron conduit. Shacks of the kind illustrated are extremely

poor fire risks, and first-class wiring within and close to the building is essential. The actual cost of a service in such cases probably does not exceed $4 or $5. In the case of the Revere company, the customers occupying these little establishments pay the cost of wiring from the pole to the house, including secondary leads serving a group of houses. The company provides all primary



FIGS. 4, 5 AND 6—PENNY SCALE AND SAUSAGE STAND GET CENTRAL-STATION SERVICE; PART OF AMUSEMENT BOULEVARD IS SHOWN IN UPPER RIGHT-HAND PICTURE

wiring, the transformer for the cottage group and the individual meters. The tenants usually return year after year.

THE SUMMER-SEASON PEAK LOAD

Both at Newport and Revere, and in many other instances where a vacation load forms a great part of the service, the annual peak comes in the summer season. Fig. 3 shows the load curve of the Revere company on the day of maximum peak, which occurred July 29. In the ELECTRICAL WORLD of Sept. 1, 1917, page 422, an analysis was printed of the economic advantages of interconnection between the plants of the Salem Electric Lighting Company, the Malden Electric Company and the Suburban Gas & Electric Company of Revere. The fact that the Revere company's peak load occurs in summer, and in the form shown in Fig. 3, is significant in the foregoing connection, since the Salem and Malden peaks occur in the winter. The Revere peak can thus be handled in part by the reserve equipment available at Salem in the summer evenings, and the generating machinery in the Revere station need be used only on the peak or whenever additional energy is temporarily required at Salem. The tie line between the three systems, all managed by Charles H. Tenney & Company, of Boston, enables the advantages of the summer peak load at Revere to be reaped to the full, and the service is handled with minimum investment and operating cost.

Summer service at Revere Beach typifies this class of business at many other highly popular resorts on the Atlantic coast. This beach is within a 5-cent-fare distance of both Boston and Lynn. In the heated season sometimes 200,000 persons visit Revere on a single Sunday or holiday, and the patronage on a week-day evening or afternoon is always heavy in good weather. A view on the Revere Beach boulevard is shown in Fig. 4, this stretch of waterfront devoted to amusement being about a mile long and occupied by the most varied concessions. The boulevard is illuminated by a great variety of sign and outline lighting, and in addition by about 2100 8-cp. lamps mounted in groups of fifty on wooden frame arches spanning the roadway. Service is rendered from dusk to 11 p. m. between May 30 and Labor Day, inclusive, the concessionnaires along the beach meeting the service cost. About $1,500 per year is derived by the company from this service.

Instances of the energy consumption of various types of concessions are interesting. A large bathing establishment used energy for lighting as follows: From May to September, inclusive, 850, 1554, 1697, 2366 and 1629 kw.-hr., or a total of 8096 kw.-hr. for the season, at 10 cents per kilowatt-hour. A dance hall consumed 9914 kw.-hr. in the season, at 10 cents, and a large coaster purchased 9800 kw.-hr., the monthly consumption at 10 cents per kilowatt-hour being 724 (May), 1889, 2473, 3527 and 1193 kw.-hr. A theater and dance hall with a 35-hp. motor consumed, including lighting, 27,730 kw.-hr., yielding the central station $1,886 from June to September inclusive, and a merry-go-round consumed 25,372 kw.-hr. from May to September inclusive, at a cost of $1,768. A coaster establishment used 44,586 kw-hr. during this period, paying the central station $2,729. This last place was equipped with five 400-watt floodlamps, a 40 hp. motor for hauling three 1-ton, ten-passenger cars to the top of the incline of the scenic railway, a 0.5-hp. organ motor, seven 500-watt bracket lamps and a 1-hp. motor driving a deep-well pump which is used to supply water to a lagoon through which the patrons pass. Another amusement palace and dance hall, equipped with 33 hp. in motors driving mirth-provoking devices, consumed 51,365 kw.-hr. during the season, at a cost of $3,068, including lighting service. The lighting and power service of another coaster totaled 32,230 kw.-hr. (100 hp. connected load), at a cost of $2,111 to the concessionnaire. Another merry-go-round yielded the central station $1,126 on 12,519 kw.-hr. (25.5 hp. in motors on the place); another scenic railway, with 75 hp. installed, consumed 37,380 kw.-hr., at $2,369, from May to September, inclusive, and another coaster consumed, with its lighting, 10,295 kw.-hr., bringing a revenue of $1,014 to the Revere company.

FIG. 7—SEVERAL LARGE COTTAGES AT YORK HARBOR, ME., ARE SUPPLIED FROM A SINGLE TRANSFORMER

Besides these large customers, there are many small establishments at this beach. It is, of course, necessary to maintain a minimum seasonal charge in all these installations of small size. The net lighting rate of the Revere company, which also serves a large all-the-year residential and business population in the territory oc-

cupied by it, is 10 cents per kilowatt-hour, with a minimum charge of $1 per month for each installation. In case the service is not used at least five months, so as to afford the company $5 net income for its use at the regular rates, the customer is required to pay to the company an additional amount sufficient to make this income $5, the additional amount, however, not being

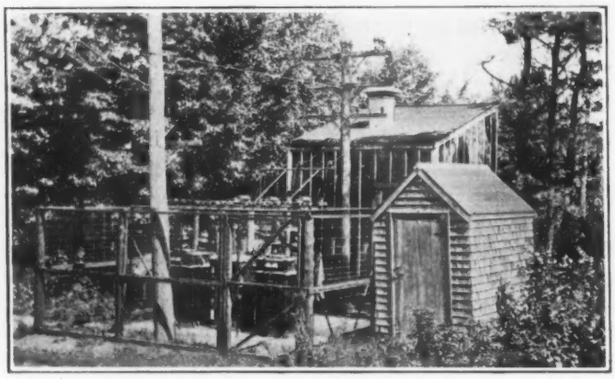


FIG. 8—OUTDOOR SUBSTATION SERVING CENTRAL-STATION SUMMER CUSTOMERS AT YORK HARBOR, ME.

allowed to exceed $2 per meter. There are no free lamp renewals on this schedule.

Examples of small lighting customers on summer service are shown in Figs. 4 and 6. The latter illustrates a frankfürter stand equipped with five 50-watt lamps, and the former a penny scale equipped with fifteen 10-watt lamps. These little installations are long-hour users of energy. On the Revere system it is customary in summer to read all meters weekly and make weekly collections of bills. The collector reads the meters.

Large customers at Revere Beach receive the benefit of a lower rate in case during any four consecutive months the customer uses more than 10,000 kw.-hr. of energy. The first 10,000 units are billed at 10 cents net, and the excess at 5 cents per kilowatt-hour.

The illuminating department of the Bay State Street Railway at Newport, R. I., has about 300 summer customers. On July 1, 1916, the company established a so-called short-term rate for residences as follows: Customers using light during the months of May, June, July, August, September and October pay only 21.5 cents per kilowatt-hour., with a 10 per cent discount on bills paid on or before the tenth of the months in which they are rendered; minimum charge, $2.22 per month. Customers having service connected for more than fifteen days during any one month are billed at the minimum charge rate for a full month. Some of the largest residences in the Newport summer colony have consumed 1200 kw.-hr. or 1300 kw.-hr. in a single month. The lighting of garages, laundries, kitchens, gardeners' quarters and lodges is considerable, and when the season is gay elaborate electrical illuminations are used in connection with lawn parties.

The yearly lighting rate at Newport for consumptions up to 100 kw.-hr. monthly is 11.25 cents net, and the power rate is 10 cents net for the first 200 kw.-hr., with a minimum charge of $2.50 per month in business places. Some of the larger residences purchase energy on power rates for the operation of elevator motors and other machinery. There is no special power rate for summer service. There is also a large summer electric railway traffic.

Besides the large residences supplied, in practically every case by underground services, in the celebrated Bellevue Avenue district, the company operates in an extensive suburban zone, having many customers on its lines during the summer who use smaller amounts of energy, say $5 or $10 worth per month. Bills are rendered monthly to all customers. As a rule deposits are not required. Some of the large customers pay for their service at the end of the season, preferring not to remit checks month by month, but in general the bills are settled monthly.

On the Maine coast electrical appliances are exceedingly popular in some of the higher class resorts, notably at York Harbor. The York County Power Company serves this district,

The York company's system includes 165 miles (265 km.) of primary lines, 70 miles (112 km.) of highway lighting circuits with summer peak load of about 1000 kw. and a winter load of 400 kw. There are a considerable number of summer hotels served by the company, yielding from $1 to $10 per day in revenue. In round numbers, the cottages yield from $2 to $75 per month from electric service. The company prefers to keep the cost of all line extensions within $100. The summer business brings in more revenue in one month than the rest of the service produces in a year. The first 100 kw.-hr. are billed at 20 cents per kilowatt-hour on the seasonal rate, all energy in excess being billed at 10 cents. There is a minimum charge of $2 per month of occupancy. The yearly lighting rate is 9.25 cents. A seasonal power rate is in use, beginning at 12 cents per kilowatt-hour for the first 200 kw.-hr., with reduction to 6 cents per kilowatt-hour for all energy in excess of 600 kw.-hr. per month. A minimum charge is made of $2 per month for installations of less than 2 hp. and $1 per horsepower per month for installations of more than 2 hp.

In supplying summer homes the joint use of poles by the central station and the telephone company saves on the investment, and the practice of running grouped house services from a centrally located transformer (Fig. 7) minimizes the outlay for overhead construc-

FIG. 9—ONE OF THE PIERS AT OLD ORCHARD BEACH WHICH AFFORD A LARGE LOAD IN THE SUMMER MONTHS

tion. A summer hotel in this district accommodating about seventy-five patrons, with twelve 25-watt lamps in its dining room, open thirteen weeks, pays about $1 per day for electric service. One 25-watt lamp per room meets the requirements well.

Hydroelectric energy is distributed through much of the Maine coastal district, and outdoor substations

serving many summer cottagers are illustrated in Fig. 8. These installations are built as inexpensively as is consistent with safe and reliable service. A few thousand dollars will provide an outdoor substation capable of meeting the electrical wants of summer communities extending over from 10 miles to 20 miles (16 km. to 32 km.) of coastline, even under present price conditions. Every house has a separate service if on the company's lines. The cottage meters are removed whenever a place is vacated, even if another tenant moves in within two hours. Meters in business establishments, amusement places, etc., are read Mondays, collections being made Wednesdays. If payment is not made by the end of the week, the service is cut off.

Long-hour lighting service is often a feature of summer resort work, the revenue being dependent upon the extent of amusement concessions offered. At Newport the Casino yields about $100 a month in lighting revenue alone. Piers like the one at Old Orchard shown in Fig. 9 are open many evening hours each week and often contain moving-picture establishments and other attractions using much electrical energy. At Old Orchard there is a scheme of decorative street lighting by stringers of 10-watt lamps from July 1 to Sept. 1, about 1500 lamps being in service. These, with seventeen 750-watt lamps, wired in multiple for beach service, yield a revenue to the central station of about $1,225 per year. The town pays for this and also meets the cost of the electric sign shown.

The experience of a central station in Massachusetts suggests the importance of more thorough analyses of cost in extending lines to summer camps. A line was built at a total service cost, including two transformers and meters for nine cottages, of about $1,000. The cottages were on an island about one-quarter of a mile (0.4 km.) long and with its nearest point about 200 ft. from the mainland. No. 6 copper was run along the island, with 30-ft. (9-m.) chestnut poles and single-phase, 2300-volt service. Although four pumps motor-driven and of 5 kw. combined rating were in service for water supply, the total revenue for a season was only about $85. The total connected load was under 10 kw., and two overhead stranded steel guy wires connected the island circuit with the mainland. The company feels that the volume of business is too small to justify the service, which includes the occasional expense of sending a troubleman more than three miles from the generating plant to the island. There is a very small use of energy despite the maintenance of a net rate of 10.8 cents per kilowatt-hour. It was felt that had the cottagers borne the cost of the extension and been charged a summer rate of 15 cents per kilowatt-hour the business might have been profitable.

A rate of 25 cents per kilowatt-hour has been successfully used for some years by the Manchester (Mass.) Electric Company in handling seasonal business with exclusive underground service among Boston North Shore cottagers. Where the density of service is high or the volume of business large much lower rates are of course justified.

In a future issue of the ELECTRICAL WORLD further information on the economic aspects of summer service will be given in the concluding part of this article, which will contain comparisons of revenue earned by central stations from month to month, with their changing peak loads and output variations.

Book Reviews

FINDING AND STOPPING WASTE IN MODERN BOILER ROOMS. By engineers of the Harrison Safety Boiler Works, Philadelphia, Pa. 276 pages, 213 illustrations. Price, $1.

The saving of coal is the purpose of this practical handbook, which is addressed to power-plant owners, managers, engineers and firemen. The preface states that such statements, tables, charts, etc., have been selected as were supported by experiments and tests, references being given wherever possible to the original authorities. The latter include many well-known engineers and writers in technical periodicals, also authors of papers before engineering societies, while the excellent bulletins on the utilization of fuel issued during recent years by the United States Bureau of Mines have been freely drawn upon. Pains have been taken to compare statements and to check each source of information against others. The work is divided into five sections, dealing with fuels, combustion, heat absorption, boiler efficiency and testing and boiler-plant proportioning and management. The book is well worth being in any engineer's reference file or library.

ENGINEERING MATHEMATICS. A Series of Lectures Delivered at Union College. By Charles Proteus Steinmetz. New York: McGraw-Hill Book Company, Inc. 320 pages, 110 illustrations. Price, $3.

This is the third and enlarged edition of a particularly interesting textbook on mathematics as commonly required by engineers in general but particularly by electrical engineers. The subject is treated with much freedom and originality. The book is divided into seven chapters, dealing with the following respective topics: The general number, the potential series, trigonometric series, maxima and minima, methods of approximation, empirical curves, and numerical calculations. There are also appended notes on function theory. Considerable skill is shown in presenting practical engineering problems illustrating the use of the mathematical processes described. The author also deserves praise for having altered the text of the first edition in order to conform to international convention concerning vector phase representation. The book will be of value to electrical engineering students and of interest to all who come in contact with applied mathematics.

Books Received

CLEARING THE GROUND. By "Lumber-Man." London: Constable & Company, Ltd. 312 pages.

MANAGING A BUSINESS IN WAR TIME. Chicago, New York and London: A. W. Shaw Company. Two volumes, 424 pages, illustrated. Price, $3.

ELECTRICITY METERS, THEIR CONSTRUCTION AND MANAGEMENT. By C. H. W. Gherardi. London: Benn Brothers, Ltd. 504 pages, 406 illustrations. Price, 15s.

ELEMENTS OF FUEL-OIL AND STEAM ENGINEERING. A Practical Treatise Dealing with Fuel Oil, for the Central-Station Man, the Power-Plant Operator, the Mechanical Engineer and the Student. By Robert Sibley and Charles H. Delany. San Francisco: Technical Publishing Company. 320 pages, illustrated. Price, $3.

STATION & OPERATING PRACTICE

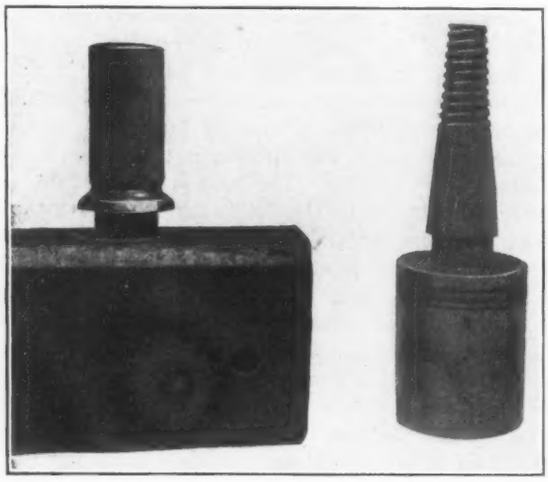
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

GAGES USED FOR TESTING WOOD PINS AND PINHOLES

Allowances Are Made for Over-Size and Under-Size Dimensions—Careless Workmanship Will Not Be Accepted and Waste Will Be Minimized

When wood pins are used to support insulators, the shanks should be of such a size that a reasonably close fit in the cross-arm will be obtained. An over-size shank may split an arm, while one too small will make the pin loose, weak and liable to decay. Obviously, pins made of such a rough material as wood cannot be procured of exact and uniform dimensions, so reasonable allowances must be made in purchasing.

The specifications of one company provide that the standard N. E. L. A. dimensions may be exceeded by not more than 2/64 in. (0.8 mm.) at the butt and by not more than 1/64 in. (0.4 mm.) under the shoulder. In



CONVENIENT GAGE FOR TESTING WOODEN PINS

order to simplify the testing of pins ordered under this specification, an iron gage with a 1½-in. (3.8-cm.) opening was made. By inserting the shanks in this gage pins may be tested with considerable rapidity. If the pin goes in as far as the shoulder and fits loosely, it is rejected as being under size; on the other hand, a pin which will not go in so that the shoulder is within ¾ in. (1.9 cm.) of the gage surface is considered too large and is also rejected.

Cross-arm dimensional specifications must likewise be of a practicable kind so that they will neither cause the rejection of adequate material nor permit the acceptance of pieces which represent careless workmanship. This company covers this point by the following specification: "Cross-section dimensions of cross-arms must not vary more than ⅛ in. (3.2 mm.) above or below the dimensions shown in blue prints. Holes must not be more than ¼ in. (6.4 mm.) off center longitudinally, or more than ⅛ in. (3.2 mm.) out of line." In checking pin-hole dimensions the gage shown is useful.

ISOLATING THE NEUTRAL OF TRANSFORMER BANKS

Tests of Change from Delta to Star Operation Show Why Insulation of Neutral of Three-Phase Star-Connected Transformers Is Important

When three transformers are used on a four-wire circuit the neutral point of the transformer bank should be isolated except in special cases, says George Wagner, superintendent of distribution of the Madison (Wis.) Gas & Electric Company. That is, it should have no connection with the neutral wire of the circuit or the ground. Some companies have tried to connect the primary neutral points of transformer banks which supply comparatively large single-phase loads in addition to three-phase loads. To take care of the unbalanced load they have installed a larger transformer in the phase supplying the single-phase load. The primary neutral wire was connected with the idea that it would carry the excess primary current for the larger transformer so as to divert it from the windings of the smaller transformers.

Some laboratory tests recently made by the Madison company brought out the fact that under the conditions cited the primary neutral carried practically no current. The tests indicated that if a single-phase load is supplied from one phase of a three-phase bank of transformers the other two transformers act as one single-phase transformer operating in parallel with the transformer on the loaded phase and share the load with it. The oscillograph records showed that the current through the primary winding of the large transformer divided and part of it passed through the primary of each of the other two transformers. The current waves of the two transformers were about the same, exactly in phase and just 180 electrical degrees from the current in the transformer on the loaded phase. The tests also showed that the current in the neutral wire is practically zero so long as the voltages are balanced. As soon as the voltages are unbalanced in the secondary delta a circulating current is set up in the delta and there is a flow of current in the neutral wire of the primary circuit.

When a single-phase load is supplied from one phase of delta-connected secondaries the load is distributed over the three transformers, the transformer on that phase supplying about one-half and the other two together the other half. The exact proportions of the load supplied by each seem to depend upon the power factor of the circuit. The three transformers divide the single-phase load in about the same proportion whether the primary neutral is connected or isolated.

The results of these tests were verified in the field by testing a bank of transformers supplying a 200-amp., three-phase load and two 100-amp. spot welders connected with only one phase. Every time a spot welder was operated current was drawn from all three transformers, the current in the neutral being practically

nothing. When the voltage on one phase was varied with the feeder regulator, however, a comparatively heavy current was set up in the neutral wire.

It follows, therefore, says Mr. Wagner, that there is no occasion for making one transformer of a bank larger than the other two combined to supply three-phase power and an additional single-phase load. Inasmuch as the neutral wire carries practically no current there would be no excess current under any circumstances in the windings of one or both of the smaller transformers if the larger transformer carried full load. In determining the sizes of transformers necessary for an installation like this it should be borne in mind that the transformer on the phase carrying the single load actually supplies only about one-half of the single-phase current; the other two supply the rest.

The tests also indicate clearly that the primary neutral points of three-phase transformer banks should be isolated unless the transformers have ample capacity to take care of their regular load plus any circulating current that may be set up on account of an unbalanced voltage condition. If one phase wire should become grounded the voltage of that phase would drop on account of the heavy current, but a transformer bank with a primary neutral connected thereto would immediately tend to equalize the voltages on the three phases. The two transformers on the ungrounded phase would draw a heavy current trying to boost the voltage on the grounded phase. The probable result would be that the primary fuse on one transformer would blow and the other two would then carry the load on open delta. If the capacity of these two transformers was insufficient, they would be overloaded and would be liable to damage.

If the primary neutral point of the transformer bank is isolated, no circulating current can be caused by unbalanced voltages, but if the fuses of one transformer rupture, the other two transformers are actually in series between two-phase wires and their secondary voltages are 0.865 normal, or about 200 instead of 220. Furthermore, the voltage across the secondary and the primary of the transformer with the fuse blown is zero when the load is straight resistance or single-phase load. If there are any three-phase motors on the circuit, they may continue running and they will tend to maintain a delta voltage. If the motors are stopped, they will, as a rule, not start, because it would be equivalent to trying to start them on single-phase energy.

CAUSE OF METERS HUMMING AND THE REMEDY FOR IT

Trouble Usually Found Due to Location of Meter and Inattention to Internal Condition

BY GEORGE M. HEWITT

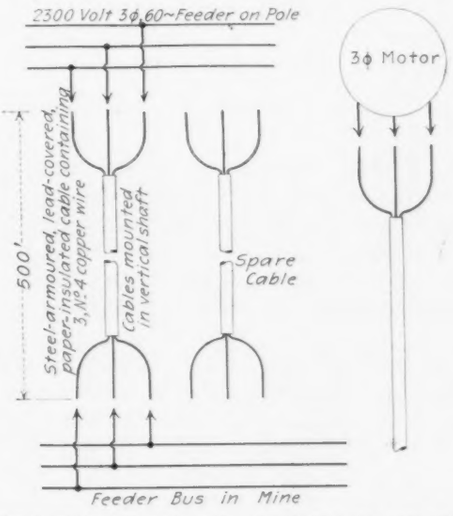
A humming meter makes an annoying noise that usually causes the customer to think that it is operating even though he has no lamps burning. Unless the meter is mounted upon a solid support, the small vibration will be amplified. Therefore, meters should not be placed upon hollow walls or thin partitions which may act as sounding boards or amplifying mediums. The meter tester can often help to reduce the noise by putting rubber washers back of the meter.

The humming of meters may be due to internal causes, for instance, loose laminations and improper assembling of operating elements, or it may be due to defects in the meter. Noise in Westinghouse meters may be caused by defective ball bearings or by the top bearing pin becoming rusted or by clogging due to dirt and dried oil in the first and second register wheels. With the General Electric meters the noise may be caused by defective top bearings, a flat jewel, a weak jewel spring or a loose light-load compensator. Other makes of meters may hum because of gummed-up top bearings, loose parts or flat jewels.

HOW A MINING COMPANY USES CABLE POTHEADS

Disconnecting Feature Employed to Save Installation of Reversing Controllers and Time in Making Emergency Connections

Two interesting and economical uses of disconnecting potheads have been worked out by N. L. Allen, electrical engineer for the American Zinc Company of Tennessee. Sometimes, in connection with the operation of its concentrator, it is necessary to reverse certain motors when the belts are thrown off for repairs.


2300 Volt 3ϕ 60~ Feeder on Pole
3ϕ Motor
500'
Steel-armoured, lead-covered, paper-insulated cable containing 3, No. 4 copper wire
Cables mounted in vertical shaft
Spare Cable
Feeder Bus in Mine

SCHEMATIC DIAGRAM SHOWING ARRANGEMENT OF POTHEADS

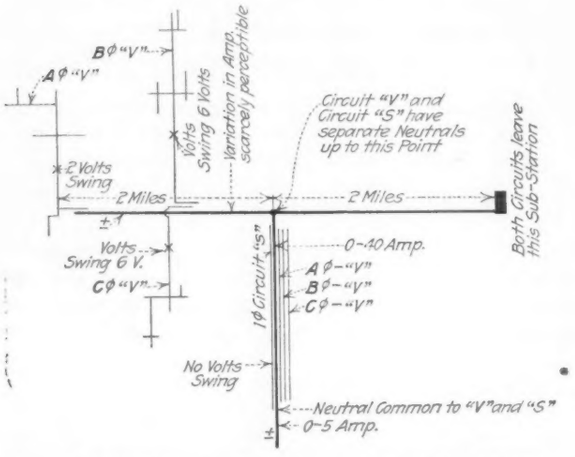
Since it is not necessary to do this very often, three G. & W. Electric Specialty Company disconnecting potheads have been installed at each motor in the three-phase leads to permit reversing the leads quickly and to avoid the necessity of reversing controllers. Of course, where the reversing of motors is more frequently necessary reversing controllers are provided. Another use of potheads is in the leads from the surface feeder to the feeder bus in the mine. The feeders on the surface, which operate at 2300 volts, three-phase, 60 cycles, are connected by means of disconnecting potheads at the pole to steel-armored, lead-covered, paper-insulated cable containing three No. 4 copper wires. These cables go down into the mine a distance of about 500 ft. (152.4 m.) to the feeder bus. A spare cable is provided for emergencies. Both of these cables are "phased out" and marked so that the potheads at both ends can be quickly and properly changed in case of damage to the operating cable.

LOCATING THE CAUSE OF VOLTAGE VARIATION

Consumers' Complaint of Flickering of Lights Leads to Extensive Investigation of Distribution System for Trouble

BY J. J. REZAB

On receiving complaints from several consumers, a central station in the Middle West discovered that an entire section of the system was affected by periodic variation in line voltage. Recording voltmeters placed in secondary circuits showed that in some instances a



SUPERIMPOSING TWO CIRCUITS CAUSES VOLTAGE TROUBLE

variation of as much as 6 volts occurred during peak hours with a frequency of 17 cycles a minute. The distribution system was fed from a substation that received its energy supply from two sources. The system consisted of three-phase, four-wire circuits with grounded neutrals and was about four miles (6.4 km.) long.

A hasty examination of the line and a review of all the power banks showed everything normal. The regulators were checked for hunting, and the compensators were tested for loose connections. It happened that a frequency changer was running idle on the line as a synchronous condenser, so a small load was placed upon the disconnected side in the hope of steadying the line; but this proved ineffectual. The primary circuits were interchanged and the neutral wire of a parallel circuit was tied to the main neutral without helping the condition of the line.

By means of a split-core current transformer the current on the neutral of one branch of the line showed a variation of from zero to 40 amp. at a periodicity of 17 per minute. The current in the phases showed no variation and the voltage did not fluctuate. Another interesting feature was that while the current in the neutral of the feeder current showed little variation, the voltage was subject to 6-volt swings. The tests at last unearthed the cause of the trouble. A single-phase circuit had been installed in the same section with a three-phase circuit, and to economize on wire only one conductor was strung for the circuit, the neutral of the three-phase system being used as the return circuit. Ordinarily this arrangement would have been suitable, but the two circuits were connected to independent sources of energy that were not in synchronism. As a result two currents occurred in the neutral wire, one moment in opposition, causing zero current, and the next moment in the same direction, causing high current.

METHOD THAT REDUCES THE COST OF SOLDERING

Utilization of an Acetylene-Gas Supply Connected to a High-Pressure Rubber Hose Permits Access to Out-of-the-Way Locations

The cost of soldering lugs on cables, leads to armature windings, etc., has been reduced as much as 60 per cent by the Iowa Railway & Light Company of Cedar Rapids by using an acetylene-gas torch for this work instead of molten metal or soldering irons. The gas is purchased in tanks and is conducted to the burner used for melting the solder by means of high-pressure rubber hose. This method permits workmen to reach locations easily which would be almost inaccessible with soldering irons, and thus the labor cost involved in the soldering process is reduced to the minimum.

WOODEN TOWER FOR A LONG-SPAN CROSSING

Necessitated Because a Steel Tower Could Not Be Secured Promptly to Serve Army Camp

To supply Camp Pike with service promptly the Little Rock Railway & Electric Company had to erect a 13,000-volt transmission line within a very short period. Since the camp was on the opposite side of the Arkansas River from the company's generating station, a 2000-ft. (606-m.) span had to be provided to cross the river. One bank of the river was about 160 ft. (48.7 m.) higher than the other, so that a relatively tall tower was required on the lower side. Not being able to secure steel towers on short notice, the company erected the wooden one shown in the illustration.

CEDAR TOWER SERVING CAMP

The tower was constructed of four 75-ft. (23-m.) red-cedar poles securely embedded in concrete and cross-braced with 6-in. (15.2-cm.) diagonals. Cross-arms, 4 in. by 6 in. (10 cm. by 15.2 cm.), were used. The total cost of the tower, which was completed in the required time, was less than one-tenth that of the steel tower of the same strength. Of course, the wooden structure will not have so long a life as a steel one would have had, but it is adequate for the purpose, as service will have to be supplied only temporarily.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

STANDARDIZING THE 50-WATT TUNGSTEN IN NEW ORLEANS

Practically No Difficulty Is Encountered in Changing from 25-Watt and 40-Watt Lamps to One of Larger Size

Within two weeks from date of delivery an initial order of 1000 50-watt tungsten lamps was entirely sold out by the New Orleans Railway & Light Company as a result of a campaign to educate the public to the value of this larger-sized lamp. It was felt that there were a great many 25-watt and 40-watt lamps in use which could be changed over to a new 50-watt lamp with better satisfaction to the consumer, and the effort was made to try to standardize the 50-watt size for household use.

As the new lamp is sold at the same price as the smaller lamp, practically no difficulty was encountered. It appeared to the public to be a chance to take a larger lamp at the same price. Further shipments of these lamps are on order and will be received at regular intervals during the rest of the year, and the campaign will be continued from time to time until this lamp is in general use.

UTILITY AND PUBLIC RECIPROCAL RELATIONS

Member of Oklahoma Commission Believes that the War Will Show How to Co-operate to Build Up Community

In a paper devoted to public relations, read before the Oklahoma Gas, Electric and Street Railway Association, A. L. Mitchell of the Corporation Commission of Oklahoma laid emphasis on the reciprocal relations that exist between the utility on the one hand and the public on the other. He closed the paper in the following words:

The most valuable asset that any public utility can have is the favor of the public that it serves. The truth of this statement is realized by most utilities at this time. Some are more successful than others in applying their realization of this fact in practice. One of the compensations in the war emergency is that the American people are forgetting supposed differences among themselves in their unanimous hostility toward the nation's enemy. With the public utilities and the public making every effort to be useful in the winning of the war, neither has time to waste in magnifying the importance of a grievance toward the other. It is likely that both will learn that if they can work best by co-ordinating their efforts toward the putting down of a common enemy, they can likewise work best by co-ordinating their efforts in the building up of the community in which they both live and in whose best success both can expect to share.

In any growing community it is necessary for all interests to experience some of the inconveniences of the pioneer. If there ever was a time when all interests and all individuals should stand shoulder to shoulder for the common betterment of mankind, it is in the present time of national emergency. When the storm is over and the clouds have lifted we expect to see the fruits of unity of purpose for the betterment of mankind. If the same spirit can be perpetuated for the betterment of the community in which each individual and each utility lives, most of the trouble due to misunderstanding of the relationship between the public and the utility will have been overcome.

INTERESTING PROVISIONS OF ARSENAL SERVICE CONTRACT

Government to Pay for Extension, with Stipulations for Company to Take It Over Later as Conditioned by Revenue Received

There has recently been executed between the Edison Electric Illuminating Company of Boston, Mass., and the Watertown arsenal a contract for the supply of electric energy by the former to the latter which contains several provisions of interest to central stations in the way of furnishing service to the government at this time. About seventy new buildings are under construction at Watertown as a part of the war program, and last summer a contract was entered into between the parties named above for the supply of electrical energy based on a line capacity of not over 250 kva. at any moment. The additions to the Watertown establishment require a line capacity of 20,000 kva. at any one moment and 14,000 kva. continuously, the supply of which necessitates the installation of four underground transmission lines, each consisting of a three-conductor 4/0 13,200-volt cable, or three transmission lines in addition to that required by the contract of last summer. These lines connect the arsenal with the L Street station of the company and are to be used solely for furnishing electric energy to the arsenal, except by prior written authority of the contracting army officer. The service includes the operation of motors, electric furnaces, lamps, etc. The arsenal is about 6 miles (9.6 km.) from the L Street station.

Four Lines Found Necessary

Last fall it was orally agreed that three lines would be provided, but it was soon found that a fourth line would be required. On Nov. 1, 1917, the company increased its power rates by the incorporation of a coal clause, and it had previously agreed with the arsenal that the energy billed over the two additional lines should be supplied at the rate agreed upon for the first line. As the cost of the service to the arsenal would be less if the running cost of the schedule of prices were applied to a single contract than if it were applied to more than one contract, it was decided to be in the best interests of the United States to amend the contract of last summer so that the schedule of rates agreed to then would apply to all electrical energy furnished by the company to the arsenal.

The supplementary agreement provides that all of the

lines are to be installed by the company at its own expense and in locations obtained by it, except that it is to be indemnified by the United States for part of the expense of installing the fourth line. As the line capacity of 2500 kva. at any moment provided for in the contract of last summer has been increased by the supplemental contract to a capacity of 5000 kva. at any moment, the minimum yearly payment per line has been raised from $25,000 to $50,000, making a total minimum charge per year, when all four lines are connected to the arsenal, of $200,000; but the arsenal is not required to pay the minimum annual rate provided for the fourth line, viz., $50,000 per year, unless and until the company shall have repaid to the United States the latter's investment in the fourth line as follows:

The United States agrees to pay the Edison company the actual amount paid by the latter for the transmission-line cable used in the fourth line installed complete ready for service, including all testing, teaming, freight and handling charges, and an additional allowance of 3 per cent of the amount so expended by the company to cover the engineering expenses of the company exclusive of duct and manhole costs and not exceeding $120,000. The company agrees to pay 4 per cent interest on the total amount paid by the United States. The cable installed under these provisions becomes the property of the United States, but so long as it is required for the purpose of supplying energy to the arsenal it can be used by the company for that purpose only without further payment to the United States than the interest above mentioned. If and when, before Jan. 22, 1921, the United States shall have paid the company $500,000 for electrical energy, the company is then to repay to the United States the amount paid for the fourth cable, which thereby becomes the property of the company; but the company is not obliged to repay this amount, except at its option, before Jan. 22, 1920, although before then the United States may have paid the company over $500,000 for energy.

Final Provisions of Contract

If the supplemental contract is not extended on Jan. 22, 1920, and the United States has not then paid the company a total of $500,000 for energy, or if the contract is extended and at the end of three years the United States has not paid the company this total for energy, so that the company is not obliged to repay the amount paid out by the United States for the fourth cable, then the company is to take the title to the cable and pay the United States such an amount as under all the circumstances shall be fair, considering the entire investment which the company has been required to make in order to supply the entire service required by the original and supplemental contracts, the length of time the company furnished energy to the arsenal, the amount of revenue received for this energy, etc. If the parties cannot agree upon a fair amount, the matter is to be referred to the chief of ordnance, United States Army, for determination, and if his determination is not accepted, arbitration is to follow.

All transmission-line cables and associated ducts which are within the arsenal premises and the meters, transformers, service switches and other apparatus usually installed by the company are installed by it in this case but become the property of the United States, which is to pay the entire cost to the company. Reasonable access to the meters, etc., is provided the company under proper regulations. The switching apparatus installed by the United States in its substation at the arsenal is required to be of a design approved by the central-station company.

SPECIAL CONTRACT FOR HOUSING OF EMPLOYEES

Homes Built for Workmen of Tire Company Are Equipped with Electric Ranges Which Give Satisfaction to Both Builder and Tenant

The Industrial Securities Company, Chicago, which is attending to the housing of employees of the Perfection Tire & Rubber Company, Fort Madison, Iowa, has just completed the construction of twenty-one houses containing every modern convenience, including arrangements for electric cooking. When the question of utility service for these houses was approached it was discovered that the local gas company was not in a financial condition to attend to the wants of the home builders. The local rate for electric service was then 8 cents per killowatt-hour, the company receiving its energy from Keokuk, Iowa, 20 miles (32 km.) distant.

Arrangements were made with the Fort Madison Electric Company, however, to take the business on a contract, from which the following is an extract:

"The first 7 kw.-hr. per counted room at 8 cents per kilowatt-hour. All energy consumed in excess of this amount at 3 cents per kilowatt-hour. Counted rooms for rate-making purposes include the billiard room, bedrooms in excess of three, dining room, dressing room, garage, conservatory, ballroom, kitchen, library, living room, music room, nursery, office, parlor, reception room if larger than 120 sq. ft. (10.8 sq. m.), sewing room, stable and studio. Rooms not counted include the alcove, attic, bathroom, bedrooms (first three), cellar, closets, coal bins, den, garret (if unfinished), hallways, unfinished rooms, sleeping porch, sun parlor and reception hall if smaller than 120 sq. ft."

It was figured that a family of four or five persons occupying a home of three counted rooms should be able to do cooking, washing, sweeping and lighting electrically through the use of 90 kw.-hr. per month. The use of 90 kw.-hr. billed at the foregoing rate would amount to $3.75, making an average rate of 4.16 cents per kilowatt-hour. The rate, of course, would be different for houses of different sizes, as the houses constructed have ranged from four to eight rooms each and the families average about five persons each.

When the first unit of ten houses was constructed Standard electric ranges were installed. This installation was completed in December, 1917. The first monthly accounts averaged $4.50 per month per customer. Since that time the housewives have had more experience with electric cooking, and for the last two months the bills have averaged $3.85 per customer per month. These housewives have found that the fireless cooker attachment of the range is a great electricity saver.

All houses in the second unit constructed contain Hughes electric ranges.

A. H. Burg of the real estate department of the Industrial Securities Company, in speaking of this installation, stated that most of the families have electric irons, electric washers and vacuum cleaners. For

convenience, the company has installed baseboard outlets in practically every room in all of the houses.

Mr. Burg said further: "We consider that by using electricity in these houses and making liberal use of extra outlets for labor-saving appliances we are giving our working people greater assistance in housework than by the adoption of any other arrangement known at present. The women living in these houses are very well satisfied, which makes for harmonious industrial relations.

"Considering the price of electric ranges and the cost of installations, we do not believe the investment as expensive by 20 per cent as if we had installed gas and bought gas ranges. The electrical installations in these houses were handled just the same as plumbing fixtures. They were purchased by the builders of the houses and are sold with the houses to the tenant as a part of the regular equipment under a general part-payment plan. Under this plan the tenant pays for all of the electricity as well as the water used during his occupancy."

THE MARGIN OF RESERVE CAPACITY IN WAR TIME

Record of Reliability Must Not Fail, Nor Must Central Stations Be Made to Distinguish Between Essential and Non-Essential Customers

In view of the difficulty of securing funds with which to carry forward central-station plant developments looking toward substantial capacity increases, coupled with long and uncertain deliveries of installation of generating equipment for ordinary commercial service, the question of allowable reserve capacity assumes more than usual interest and importance. A great deal of thought has been expended upon the safe allowance for reserve which a central station should plan to maintain, and a widely acceptable expression of this allowance is found in the custom of retaining a reserve equal in rating to the largest generating unit of the station. The question now is, shall a closer margin be permitted in view of the relatively large amount of war business being served by the central stations, its non-permanent character and the willingness, for the present at least, of ordinary users to suffer some inconvenience in case of plant trouble?

At a recent round-table conference of the managers of a group of central stations this question was discussed at some length. The point was made that the war business must be served first, last and all the time, and that it exercises an absolute priority against ordinary commercial service. The view was advanced that a central station should go very slowly at present in increasing its capacity except for war service, and that the reserve capacity may properly be allowed to decrease considerably before the utility draws upon the resources of the manufacturers and the bankers for plant enlargement for commercial demands pure and simple. In case of a failure of units, partial or complete, the argument ran, let the war service be supplied first, and if trouble makes it necessary for the commercial service to be cut off to a greater or less degree until repairs can be effected, let the consumer of said commercial service do the worrying. Then when the war is over the amount of invested capital to be carried in plant will be less than if expansion had followed the ordinary lines, and in the meantime resources will be more effectively devoted to purely war purposes.

As soon as the central-station manager attempts to classify his customers as essential and non essential to the war work of the country, he takes upon himself an exceedingly heavy responsibility and a most difficult task. The whole central-station industry has been built up on the basis of a remarkable record for reliable service, and so far as possible this record should not be allowed to fall off during the war period. It is unquestionably true that the munitions plant should be the first to be supplied with service in case of trouble, but surely the efforts of the central station should not stop here. A conservative policy with respect to taking on new business is one thing, and cutting off or threatening to discontinue existing customers is another. Expansion of plant must proceed to-day along lines with which the government is in sympathy, but even more in serving war customers is a substantial reserve in plant capacity most desirable. Through the practice of economies in operation the existing equipment can be made to do much more work in many cases than before; and through interconnection for energy interchange between adjacent plants, no matter whether of common or unrelated ownership, a good deal of reserve capacity formerly held against the "rainy day" in a particular station can be released for other uses. Here, indeed, will be the probable solution of not a few plants seeking to maintain a safe reserve in the face of what is almost a governmental interdiction of local station expansion along the orthodox lines. As the amount of war business to be handled grows, new equipment must of course be added in many cases, and if interconnection, extending in some instances to local mill plants and even to office-building and similar power installations, is worked out along proper engineering lines, the bogie of the shrinking individual reserve will tend to disappear, and along with this advance will go a maintained service reliability which will always be the pride of the industry.

NO FREE RENEWALS FOR SMASHED LAMP BULBS

The Boston Policy of Placing Burden of Careless Breakage on Customer Has Worked Out Satisfactorily

The Edison Electric Illuminating Company of Boston, which has been very liberal in regard to broken and lost lamps, has found that present-day conditions have made certain economies necessary, among them being a change in lamp policy outlined in a notice sent to customers which stated that on and after Feb. 15, 1918, a charge would be made for lamps replaced where the glass is broken. This does not change the renewal service furnished by the company, but places the burden of careless and excessive breakage on the customer.

The handling of broken lamps under the new rule has been in effect now for more than two months with remarkable success, the company states, and is operating with notable smoothness. The customers seem to appreciate that property furnished for their use by the company must be properly handled and receive due care in order to prevent its unnecessary destruction.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Alternating-Current Asynchronous Motors with Short-Circuited Rotors.—J. A. MONTPELLIER.—Practical notes upon the theory and performance of these machines, the use of which in silk-weaving and similar factories was recently advocated in the same journal. *L'Industrie Electrique*, April 10, 1918.

Induction Generators with Phase Advancers.—Dr. Kapp in the discussion on L. B. Wedmore's paper at the Birmingham meeting of the Institution of Electrical Engineers made a strong plea for the use of induction generators in conjunction with synchronous generators and phase advancers to simplify and reduce the cost of protective devices and switch gear of large generating stations. The phase advancers would enable the induction machines to take their fair share of the reactive component of the load. In the editorial comment on this paper it was stated that the reliability of the phase advancer must be considered in comparison with the exciter. The use of governors with induction generators, the mechanical difficulties arising from small air gaps of the induction machine, the need of a laminated rotor, the loss in the end bells due to induced currents of slip frequency, and so on, must also be considered. Where it is merely a matter of supplying reactive current, it is probable that the future great demands will be made on the rotary converter rather than on the induction generator, and when the adoption of the latter machine to simplify switch gear does prove feasible, it should be seriously investigated before action is taken.—London *Electrician*, April 5, 1918.

Standardization of the Ends of Electric Motor Shafts.—A step toward further standardization has been taken by the electrical constructors of France in adopting uniform dimensions for shaft ends. A table of these is given.—*Revue Générale de l'Electricité*, April 13, 1918.

Mechanical Design and Specifications of Turbo-Alternator Rotors.—S. F. BARCLAY.—Concluding paper on the subject read before the Institution of Electrical Engineers. In this section the design of rotor end bells is described, together with the best methods available for procuring adequate ventilation.—London *Electrician*, March 29, 1918.

Ventilating System for Steam Turbine Alternators.—E. KNOWLTON and E. H. FREIBURGHOUSE.—The power output which can be obtained from generators depends for the most part on the dissipation of heat in the machine. While natural ventilation methods are adequate for generators driven by slow reciprocating engines, a greatly increased amount of air is required owing to the change in the method of operation. Excessive temperature shortens the life of the insulating material, decreasing it in proportion to the temperature and the time during which it is maintained. Curves are given which show the percent of rated loads which turbine alternators can carry as a function of the temperature of the entering air.—*General Electric Review*, April 1918.

Elementary Principles of Continuous-Current Armature Windings.—F. M. DENTON.—This is an article continued from the issue of April 5, in which continuous-current armature windings are classified and the derivations of the usual winding rules are developed by a simple method based upon an understanding of the well-known Gramme ring type. The rules governing multiplex, single re-entrant, treble re-entrant and series-parallel windings are also considered.—London *Electrician*, April 12, 1918.

Lamps and Lighting

High Candle-Power Projection Incandescent Lamps.—A considerable amount of work on the design of incandescent lamps for projection work has been carried out of late. According to a recent contribution by O. Kruh in *Elektrotechnik und Maschinenbau*, it has now been found possible to make lamps taking up to 200 amp. and giving 30,000 to 40,000 hefner candles. While even 100,000 candles is considered practicable, the chief limit is the size of the lamp bulb. The great difficulty hitherto in constructing such high-candle-power lamps has been with the leading-in wires. It is not easy to secure an air-tight joint for such high currents, but according to the author this can be done by a special method, which, however, he does not disclose in this article. Such lamps work at about 0.25 watt per candle (hefner). The filaments are mounted in the form of straight bars, as close together as possible, and their useful effect is increased by the use of concave mirrors behind the filaments, the latter being at the center of curvature of the mirror. The mirror can be so adjusted that the image of the filaments completely covers the interstices between them.—London *Electrician*, April 12, 1918.

Generation, Transmission and Distribution

Electric Power Supply and Coal Conservation.—The problems which would be involved in assembling more than 600 segregated districts into a comprehensive system, in selecting sites for the proposed super-power stations and in combining by-product plants with the generating plants are subjects discussed in this article, which represents a discussion on the interior report of the coal conservation sub-committee on electric power supply of Great Britain.—London *Electrician*, March 29, 1918.

Some Advantages of Central-Station Service.—W. S. BUCHANAN.—The prevalent practice to-day is toward centralization of energy production and the elimination of the isolated-plant idea, with the object of effecting substantial economies in both operating costs and fixed charges. This article discusses this subject in detail.—*The Central Station*, April, 1918.

Ventilation System for Steam-Turbine Alternators.—E. KNOWLTON and E. H. FREIBURGHOUSE.—The cause of moisture condensation on the internal parts of the generator and the means of preventing this troublesome condition are discussed.—*General Electric Review*, May, 1918.

Types of Electric Motors, Their Construction and Characteristics.—GORDON FOX.—Some desirable features that should be embodied in a motor are outlined to assist in the selection of machines from the standpoint of mechanical design and construction. The subject is discussed under the following headings: Pole pieces and armatures, the commutator, windings, brushholders and brushes, and bearings.—*Power Plant Engineering*, May 1, 1918.

Control of Large Amounts of Power.—E. B. WEDMORE.—Protection of systems in which a large amount of power must be generated and distributed was discussed in a paper read by the author before the British Institution of Electrical Engineers. The chief subject dealt with was limitation of disturbances by sectionalizing and by the employment of reactances. Under the latter head generator reactances, feeder reactances and busbar reactances were considered. Improvements of power factor, the interconnection of stations, influence of live load on short-circuit current and limiting disturbances by the use of protective relays were other subjects discussed. The appendix gives the rupturing capacity of oil switches, rating of reactances, desirable arrangement of busbars, the value of busbar reactances in limiting current, the extent to which load can be transferred through reactances, considerations that should be taken into account in designing current-limiting reactances, etc. Diagrams are given showing the force exerted on parallel conductors carrying current, a typical oil switch and a typical isolated switch subject to large forces and small forces. Various curves showing the effect of different methods of reducing short-circuit current are also given. An arrangement permitting the maximum transfer of load is illustrated. The author says that from experience with stations designed in recent years and having a maximum short-circuit current of ten times their normal rated output, it is necessary that the smallest current transformer on the main switchboard should have a carrying capacity of not less than one twentieth of the station output.—London *Engineering*, April 19 and 26, 1918.

Standardized Flexible Distribution Systems in Industrial Plants.—BASSETT JONES.—The second and concluding article on the subject gives the method of installing a lighting system in the new factory of the Sprague Electric Works at Watsessing, N. J. The arrangement of the entire system is produced and photographs of the installation are given.—*General Electric Review*, April, 1918.

Joining High-Tension Underground Cables.—While cables laid in bad condition may give good service for years, faulty joining will probably cause constant trouble. Three things are necessary in this connection—a good union of the conductors, insulation of the joint, and protection of the joint against dampness. Apart from accidental defects, the most common causes of destruction are external injury, chemical action, electrolysis, earth slides, floods, vibration and overtension. The author considers the best means of combating these sources of injury, including two methods of protection against electrolysis—first, connecting the lead sheath to earth; second, the insulation of the sheath from the earth.—*Boletin de la Asociación Argentina de Electro-Técnicos* (Buenos Aires), February, 1918.

Installations, Systems and Appliances

Electric Winding Engine.—JOHN F. PERRY.—The chief systems of electric winding are briefly described and their merits compared with the steam methods. Eight alternative schemes are presented. The distribution of energy losses and working and initial costs are analyzed by the aid of diagrams. A table is given showing the performance of electrically driven winding engines, giving the depth of the pit, the output per ton-hour, net load, etc.—London *Electrician*, April 5, 1918.

Electrophysics and Magnetism

Photoelectric Effects on Mercury Droplets.—JOHN B. DERIEUX.—It has been shown that never more than one elementary charge at a time is detached from a neutral air molecule by primary or secondary X-rays. It seems probable that in the photoelectric effect on mercury droplets two electrons are never liberated at the same time, and that when two liberations appear to be simultaneous there are really two distinct liberations, the interval between them being too short for the observer to separate them. In investigations with mercury droplets subjected to long wave lengths the lines were too faint to give a rapid discharge even with the collimator slit open wide and the lamp operating on high energy owing to the minuteness of the droplets. The long wave-length limit evidently lies between 253.5 μμ. and 312.6 μμ.—*Physical Review*, April, 1918.

Young's Modulus of Drawn Tungsten.—H. L. DODGE.—This paper is the fourth of a series upon the effect of temperature on the elasticity of tungsten wires. Tests were made upon a piece of drawn tungsten wire containing approximately 99 per cent tungsten and 1 per cent thorium. The Young's modulus of drawn tungsten was found to be 35.5×10^{11} dynes per square centimeter at 20 deg. C. The modulus decreases uniformly with increase of temperature up to 1000 deg. C., at which temperature it is 32.3×10^{11} dynes per square centimeter.—*Physical Review*, April, 1918.

Theory of the Oscillations of the "Singing" Arc.—LIEUT.-COL. J. B. POMEY.—The author works out a problem to show what the amplitude of the oscillating current of the "singing" arc depends on and gives a formula by which a close approximation to the value of the efficient intensity of the singing oscillatory current may be derived.—*Revue Générale de l'Electricité*, April 20, 1918.

Electrochemistry and Batteries

The Fixation of Atmospheric Nitrogen.—In the *Zeitschrift des Vereines Deutscher Ingenieure*, H. Andriessens describes an arrangement working on the same principle as the Birkeland furnace for obtaining nitrogen by the direct combustion of air and for which 80 per cent higher output is claimed by the adapter. In the Andriessens furnace it is the aim to obtain the maximum linear extension of the arc and the minimum flame surface, on the ground that the reaction velocity

between nitrogen and oxygen is extraordinarily high, so that the sooner the products can be removed from the flame zone the less the extent to which dissociation will occur. The nitric oxide should be cooled down in the shortest possible time, the writer says, but previous methods do not take account of this requirement. To obtain the maximum length arc with the smallest flame surface an air blast is delivered between two vertical rod electrodes set below but in the same vertical plane as the line joining the poles of a powerful electro-magnet. The net result of the air blast and magnetic field is to spread the arc over a surface limited by a helix which may have a pitch of only a few millimeters. The air velocity may be four times that usual in the Birkeland furnace. From a 35-kw. furnace the yield may be 70 gm. (referred to 100 per cent nitric acid) as compared with 30 gm. to 45 gm. from a Birkeland furnace of equal power, it is said.—London *Electrical Review*, April 12, 1918.

The Storage-Battery Industry.—L. JUMAU.—In this article, which is a sequel to others published in the *Revue Générale de l'Electricité* for Aug. 4 and Oct. 6, 1917, the author describes the principal processes used in making electrodes for lead storage batteries and the different methods employed for mounting them. He sums up the results that may be obtained with storage batteries such as ampere-hour capacity, life of the electrodes, etc.—*Revue Générale de l'Electricité*, April 20, 1918.

Units, Measurements and Instruments

Losses in Sheet Iron at High Frequencies.—MARIUS LATOUR.—In this study, communicated to the International Society of Electricians in its session for 1918, the author determines the power dissipated separately in the form of Foucault currents and hysteresis in a sheet of iron, admitting that there is a constant angular retardation between the induction in the iron and the field which produces it. From this he deduces the thickness which the sheet iron of an apparatus fed by a high-frequency current ought to have in order that the minimum total power should be dissipated. Then he calculates the extent to which the voltage and the current in the circuit of a self-inductive coil are out of phase.—*Revue Générale de l'Electricité*, April 13, 1918.

Miscellaneous

Hydroelectric Power—Its Relation to Industry.—J. A. JOHNSON.—The author says: "The nation is facing the greatest crisis in its history, not only in a military sense, but in a political and economic sense, and we are on the eve of a great development of the hydroelectric power resources of this country." He then goes on to outline different types of hydroelectric development, pointing out how some have uniform continuous flow of water and others have variable flow, discusses the cost of developing hydroelectric power and calls attention to the results of failure to co ordinate power developments and industrial applications.—*Metallurgical and Chemical Engineering*, May 1, 1918.

The Electric Commercial Vehicle.—The electric truck is desirably fulfilling service requirements due to the increased capacity and improved operation obtainable with present storage batteries. A vehicle equipped with a standard battery and having a carrying capacity of 1000 lb. to 1500 lb. (453 kg. to 680 kg.) will run about 50 miles (80 km.) on one charge, while the larger sizes carrying from 3 tons to 5 tons will travel from 35 miles to 40 miles (56 km. to 64 km.). The lack of battery-charging facilities that heretofore existed has now been overcome considerably, and there is no doubt that the commercial electric vehicle is here as a permanent transporting medium. The running costs of this type of electric vehicle are low in spite of the fact that the initial outlay is higher than for either steam or petrol wagons. The depreciation on an electric vehicle may be figured at 10 per cent, while 15 per cent is reasonable for the petrol wagon.—London *Engineer*, April 12, 1918.

How the Electric Truck Releases Men for Productive Work.—F. C. MYERS.—Seven examples show how as many as several hundred men have been released from the work of handling material in industrial plants through the installation of carrier and tractor trucks each of which has its field of application and operates economically under certain conditions. The carrier trucks carry their load, while the tractor trucks pull their load along. Neither type depends on tracks or special roadway. Grades up to 15 per cent can be negotiated without trouble, but the steepness of the grade will, of course, decrease the weight that can be carried or hauled. In some instances wooden runways and concrete yard roadways are desirable. The average cost of operation for a ten-hour day is approximately $1.20 in the plants referred to, including interest, depreciation and maintenance.—*Industrial Management*, April, 1918.

Fuel Problem in the Middle West.—A. A. POTTER.—That future emergencies can be averted by more adequate fuel storage, by greater attention to fuel economy, by the more careful regulation on the part of the government of the quality of fuel leaving the mines and by bettering fuel-transportation facilities is the opinion of a number of power plants in the Middle West, says the author. The larger power plants are expecting to store greater amounts of coal than usual. Some plants expect to provide storage capacity sufficient for thirty days. Spontaneous combustion has caused some difficulty in storing many of the Middle Western bituminous coals, but storage under water will be used to a considerable extent. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, states that in addition to the investment in land for storage facilities and the railway improvements attached thereto there is considerable expense in carrying coal over year after year; but even this outlay and expense is warrantable from a business point of view. A detailed study of coal-car movements in the Middle West during the past four years discloses the fact that the average time required to move cars is extremely long. In most cases cars carrying coal will average less than 20 miles (32 km.) per day. When this time is added to the time required for empty cars to return to the mines, it is evident that the coal tonnage handled per car per year is very limited and very much smaller than reasonably efficient operation should produce. This delay is partly blamed upon the railroads for throwing cars on sidings and into yards with unnecessary switching, instead of delivering them to their destination in one or two hauls. Pooling of engines, cars and routes and routing coal so as to avoid large cities will tend to improve the situation.—*Journal of the American Society of Mechanical Engineers*, May, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

PRESENTATION OF EDISON MEDAL TO COLONEL CARTY

Chief Engineer of the American Telephone & Telegraph Company, Now Serving in the Army Signal Corps, Receives Honor

A large audience, gathered in the Engineering Societies Building, New York, at the annual meeting of the American Institute of Electrical Engineers on May 17, witnessed the presentation of the eighth Edison medal to Col. John J. Carty of the United States Army Signal Corps, chief engineer of the American Telephone & Telegraph Company. The award of the medal to Colonel Carty for his work in the science and art of telephone engineering was announced in the ELECTRICAL WORLD of May 4, 1918.

Those to whom the medal has been awarded in previous years are Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell and Nikola Tesla.

COL. J. J. CARTY

Dr. A. E. Kennelly, professor of electrical engineering at Harvard University and Massachusetts Institute of Technology, told of the history and significance of the medal.

Dr. Michael I. Pupin of Columbia University said: "Carty's life is filled with romance. He never went to college. At the age of eighteen, when other boys entered college, he entered the service of the American Bell Telephone Company and at the age of twenty-eight became chief engineer of the great New York Telephone Company."

E. W. Rice, Jr., president of the Institute, made the formal presentation of the medal.

In accepting the medal Colonel Carty gave credit for the American telephone achievements to the engineers who have been associated with him in the Bell system and paid a tribute to Major-General George O. Squier, chief signal officer of the United States Army.

The newly elected Institute officers, who serve during the administrative year beginning on Aug. 1, 1918, were the directors' nominees, as follows:

President—Prof. Comfort A. Adams, Harvard University and Massachusetts Institute of Technology, Cambridge, Mass.

Vice-presidents—Allen H. Babcock, San Francisco; William B. Jackson, Chicago; Raymond S. Kelsch, Montreal; F. B. Jewett, New York; Harold Pender, Philadelphia; John B. Taylor, Schenectady, N. Y.

Managers—G. Faccioli, Pittsfield, Mass.; Frank D. Newbury, Pittsburgh; Walter I. Slichter, New York.

Treasurer—George A. Hamilton, Elizabeth, N. J.

WESTINGHOUSE BUSINESS TOTALS LARGE FIGURES

Value of Unfilled Orders on April 1, 1918, Is $147,000,000, of Which $110,100,000 Is for Regular Products of Company

Evidence of the large demand upon electrical manufacturing companies is shown by the statement in the annual report of the Westinghouse Electric & Manufacturing Company that, as of April 1, 1918, the value of unfilled orders in hand was $147,857,580. Of this amount $110,185,007 was for regular products of the company. On March 31, 1917, the value of unfilled orders for regular products of the company was $39,776,739. Sales billed in the fiscal year ended March 31, 1918, by the company and its proprietary companies, except the New England Westinghouse Company, aggregated $95,735,407. This total compares with $89,539,442 in the preceding fiscal year. The amount of sales billed, as stated for the year just ended, includes shipments since June 15, 1917, from the machine works (formerly Westinghouse Machine Company), also $4,536,000 for munitions.

"The volume of sales billed for the regular products of your company," says Col. Guy E. Tripp, chairman of the board of directors, "was greatly in excess of any previous year."

In mentioning the large total of unfilled orders in hand, Colonel Tripp adds: "No facilities heretofore employed on regular products are engaged on munition work."

Colonel Tripp said in part in speaking of the work and changes of the year:

The plan referred to in the report for last year for the merger of the Westinghouse Machine Company with your company was made effective as of June 15, 1917. The accounts of the two companies were consolidated on a basis that resulted in no change in the surplus of your company because of the merger.

The property and plant account includes expenditures during the year in connection with the new plant known as the Essington Works, located near Philadelphia, to which reference was made in the report for last year. This plant,

which is now completed and nearly equipped, is operating with a force of about 3000 men, which it is expected will be increased to approximately 5000 during the year. Contracts with the United States government for equipment for cargo ships will occupy the capacity of this plant for approximately two years.

Another important improvement completed during the year is a factory at Trenton, N. J., for the manufacture of incandescent lamps. This factory has been in operation for some months.

The increase in investments includes a subscription for Liberty loan bonds of the second issue, the only other important additions being the capital stocks of other companies acquired under the merger of the Westinghouse Machine Company and your company.

In the latter part of 1916 a proposal was submitted to your directors for the purchase of a small portion of your holdings in the British Westinghouse Electric & Manufacturing Company, Ltd., in order that a controlling interest might be transferred from the United States to England. After careful consideration your directors concluded that the commercial position of the British Westinghouse Electric & Manufacturing Company, Ltd., would be improved if the control of that company were owned in England instead of the United States, but decided that the sale of your entire holdings was the only satisfactory solution of the situation. Accordingly negotiations were concluded under which your holdings of 4 per cent debenture stock and preference and ordinary shares in the British company were sold to a syndicate formed in London (Electric Holdings, Ltd.) and payment therefor has been received in 5 per cent prior lien debenture bonds maturing in ten years. These bonds are secured by the pledge of all the said securities sold and certain other additional collateral. This change in your investments was made without change in book values and has, therefore, not affected the balance sheet.

Certain new trading agreements of mutual advantage have been entered into between the British company, Electric Holdings, Ltd., and your company. The great increase in the demand for the regular products of your company, as shown by the volume of business completed during the year and by the volume of orders in hand, has required large increases in working and trading assets.

The consolidation of accounts resulting from the merger of the Westinghouse Machine Company with your company brings into the balance sheet this year the outstanding balances of bonds and debentures issued by the Machine company. The total of the annual sinking fund requirements with respect to all these issues is $150,000.

Your company's ten-year collateral notes, aggregating $2,720,000, maturing Oct. 1, 1917, were paid and the collateral has been returned to the treasury of the company. Additional notes of the issue of fifteen-year 5 per cent notes due Jan. 1, 1924, were offered during the year and redeemed, leaving only $52,500 outstanding of the several issues of notes made in 1909.

Reference has already been made to the large increases in inventories made necessary by the unprecedented volume of your company's business. As a result your company during the year increased the total of its outstanding notes payable by $12,282,301, the total amount of notes payable outstanding as of March 31, 1918, being $30,186,051. This includes $15,000,000 one-year notes and $2,433,551 on account of Liberty loan bonds subscribed for by your company and its employees.

In the report for last year you were advised of a modified agreement made with the British government with respect to the contracts for the manufacture of Russian rifles. The New England company under this modified agreement was regularly producing rifles in excess of the originally estimated capacity of its plants, but when slightly more than 1,000,000 rifles had been delivered, and probably because of the conditions arising in Russia resulting in the withdrawal of that country from the war, the British government in December, 1917, exercised its privilege of cancellation of the undelivered part of the contracts. However, almost simultaneously with the receipt of this notice of cancellation inquiries were received from the United States government as to the manufacture by the New England company of heavy Browning machine guns. Negotiations resulted in the receipt of orders from the United States government, thus enabling the New England company to retain its organization, not only to its own advantage but especially to the advantage of our government in having available for immediate use both manufacturing facilities and a trained organization for the production of machine guns. Deliveries began in April and are in advance of the schedule fixed by the contract.

The cancellations of the Russian rifle contracts resulted in your company sustaining the full loss of $5,000,000, against which a reserve in that amount was set aside last year. Your directors therefore authorized the absorption of this amount in said reserve. The necessary entries were made as of Dec. 31, 1917, so that the books of your company as of March 31, 1918, include no accounts relating to the contracts for Russian rifles.

The entire outstanding capital stock of the New England Westinghouse Company is owned by your company and is carried at a valuation considerably below the estimated value of its real estate and buildings and other assets which are free of all indebtedness or encumbrance of any nature. The contracts with the United States government for machine guns are on a cost plus basis.

The abnormal conditions prevailing during the year called for unusual effort on the part of the officers and employees of your company. The board of directors has pleasure in hereby expressing its appreciation of the efficient manner in which the unusual conditions were met and the general devotion to the company's interests evidenced throughout the year.

The income account for the last year follows:

Gross earnings—Sales billed		$95,735,407
Cost of sales—Factory cost, including all expenditures for patterns, dies, new small tools and other betterments and extensions; also depreciations of property and plant, inventory adjustments and all selling, administration, general and development expenses and all taxes		80,225,937
Net manufacturing profit		$15,509,470
Other income—interest and discount	$308,835	
Dividends and interest on sundry stocks and bonds owned	903,559	
Miscellaneous—royalties, etc.	112,869	1,325,263
Gross income from all sources		$16,834,733
Deduction from income—interest on bonds and debentures	$303,917	
Interest on notes payable	1,108,046	
Miscellaneous interest	17,089	$1,429,052
Net income available for dividends and other purposes		$15,405,681

The surplus as of March 31, 1917, $18,105,298, was increased by the net income of $15,405,681 for the year, making the gross surplus $33,510,979.

In addition to the regular quarterly dividends at the rate of 7 per cent per annum on the preferred and common stocks, a special "Red Cross" dividend was paid, making a total of $5,610,848 for all dividends paid during the year.

Special appropriations were made for the protection of inventory book values and to establish a research and development fund. After deducting these appropriations and other miscellaneous adjustments the net surplus as of March 31, 1918, is $26,404,694, an increase of $8,299,396 over the net surplus as of March 31, 1917.

Damage by Tornado in District of Iowa

A tornado twisted through Newton, Iowa, on Tuesday of the present week. Some damage was done to the buildings of several washing-machine manufacturers, but a representative of the ELECTRICAL WORLD telegraphs from that district that these companies will make deliveries as usual and that output will be curtailed for only a few days. The electric central station was not injured, but the damage to poles and lines is estimated at $5,000. Telephone and telegraph lines were also damaged.

WATER POWER COMMITTEE BEGINS TO FRAME BILL

W. H. Onken, Jr., Shows that Industries Depending on Hydroelectric Energy Are Far More Valuable than Generating Systems

The joint water-power committee of the House of Representatives has begun the framing of the bill which will be based upon the so-called administration water-power bill and is to be reported to the House in the form of an amendment to the Shields bill passed by the Senate some time ago.

It was intended last week that hearings should continue for the benefit of some members of the House who desired to be heard, but the committee decided to close the hearings and held the record open only for the insertion of a statement prepared by William H. Onken, Jr., editor ELECTRICAL WORLD, who had attended all of the hearings, and who, because of the unbiased position in controversy of the editor of the ELECTRICAL WORLD, it was felt, could treat of subjects which had not received much attention at the hearings. Mr. Onken's statement ended the taking of testimony.

It is not known in Washington when the bill will be reported to the House. A number of points, it is stated at the office of the committee, have been tentatively agreed upon, but it is expected that there will be much discussion over a proposal being made by Representative Anderson of Minnesota and Representative Raker of California that the commission provided for in the bill shall consist of more than the Secretaries of War, Interior and Agriculture. It is stated that these Representatives are urging a commission of five, two members to be experts in water-power legislation and administration, although not necessarily engineers.

A COMMON FALLACY

In Mr. Onken's statement he pointed out that it is a fallacy to believe that in granting a license to develop water power the government is parting with something that is very valuable, for, he said, the value rests not in the water power itself, nor in any great measure in the electricity generated from it, but to an enormous degree in the industries, cities, farms and homes dependent on electricity as a modern necessity. The industries depending upon electricity are infinitely more important, he said, than the electric generating systems. He directed attention to the enormous savings made possible by hydroelectric development, and said that during 1917 540,000,000 tons of bituminous coal were mined, requiring the employment of more than 500,000 men and for its shipment the movement of hundreds of thousands of cars and locomotives.

"Since on the average it requires 1000 tons of coal to produce 125 hp.-years of electricity," Mr. Onken said, "35,000,000 undeveloped water horsepower put to use would save the necessity of mining 280,000,000 tons of coal per annum and the labor of from 500,000 to 700,000 men." These men, he said, would be available for military and industrial purposes.

Mr. Onken also said:

"As typifying what hydroelectric development means to a community and at the same time showing the enormous waste caused by non-development, the case of Niagara Falls is unique. The mighty cataract alone, not including the rapids, is capable of developing 5,000,000 hp. This, if sold at the modest rate of $20 a horsepower year, or what is equivalent to 3 mills per kilowatt-hour, would yield a revenue of $100,000,000 per annum. This amount of money is equal to a 5 per cent return on an investment of $2,000,000,000, and yet what government would spend that stupendous amount of money to reproduce the spectacle? It is true, we have power companies which develop a fraction of the power available, but the roar of Niagara is as nothing compared to the din of the industries set in motion by the electricity generated from only a fraction of the water in the cataract.

THE SITUATION AT NIAGARA FALLS

"At Niagara Falls are the greatest electrochemical industries of the world. More could be established there if more power were available, but because of the shortage of power many have been forced over into Canada and still others have gone abroad. These electrochemical industries are of vast importance to this nation. They started at Niagara Falls and for the greater part they still remain, handicapped as they are for want of electricity. On these electrochemical industries depend numerous other industrial establishments throughout the country, valuable in times of peace, but infinitely more valuable in the critical times of war.

"First of the electrochemical enterprises in point of electric power requirements is the aluminum industry. Next in line come the ferro-alloy compounds, including ferro-silicon, ferro-chromium, ferro-molybdenum and so on. The next electrochemical industry in point of size is devoted to the manufacture of calcium carbide, used chiefly in the production of acetylene. Artificial abrasives, which constitute the basis of all modern grinder work, are also manufactured at Niagara Falls, as well as caustic soda, chlorine in the form of bleaching powder and other chlorine products; chlorates, which are used in the match industry, in the textiles, for the manufacture of oxygen and in other chemical operations; sodium, used in the textile industries as a bleaching agent and which is still more important in the manufacture of sodium cyanide; phosphorus, carbon bisulphide and numerous other products absolutely indispensable to industry to-day.

"I need not call the attention of the committee to the importance of aluminum and aluminum products. The ferro-alloys, however, give one a very good idea of how indispensable the products of the electrochemical industry are. Approximately 75 per cent of all the steel made in this country to-day is made in the basic open-hearth furnace, and all that steel requires in its manufacturing the use of ferro-silicon. In other words, the whole of the steel industry in this country is at the present time dependent on ferro-silicon made in the electric furnace by the application of electric power. With no ferro-silicon there can be no open-hearth steel.

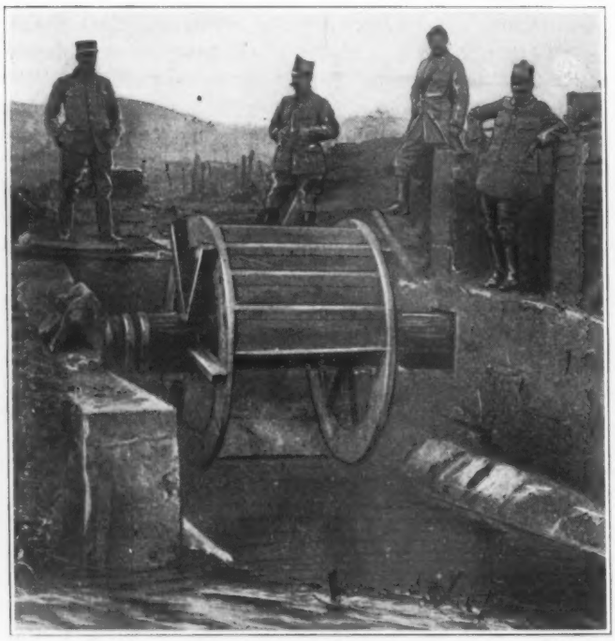
GREAT IMPORTANCE OF ELECTROCHEMICAL INDUSTRIES

"The artificial abrasives show the extreme importance of electrochemical industries to other general industries. The automobile and aeroplane furnish a citation. All of the abrasives used in this country at the present time are electric furnace products. Now, there is hardly a single portion of an automobile or of an aircraft that has not got to be ground in some form or

other. There is not a single bit of steel in the automobile that is not dependent on the electrochemical industry for ferro-silicon. There is not a single part which has been lightened in weight that does not involve the use of ferro-chromium. By the use of alloy steel alone the weight of automobiles has been cut in half and at the same time increased in strength and reduced in cost. So greatly does the automotive industry depend on these products that without the use of the high-speed tool steels which the electrochemical industries alone make possible, and without the use of the grinding wheels which the electric furnace has given to the world, a plant which can manufacture 500 cars a day could turn out only 100 cars a day with the same outfit and the same men.

"It is needless for me to continue further along this line to impress you with the vast importance of electrochemical products to other industries, ignoring entirely the fixation of atmospheric nitrogen for fertilizer and for munition work. I merely cite the case to show how infinitely more important are the industries depending upon electricity than the electric generating system itself. It is of interest to note in this connection that the combined income from the sale of electrical energy of the Niagara Falls Power Company and the Canadian Niagara Power Company for 1917 was a trifle more than $3,000,000. I have no statistics showing the output of electrochemical products manufactured from the electricity sold for that purpose nor the cost of the numerous other products which in their fabrication involve electrochemical products. However, the citations given indicate the stupendous value of these products as compared with the cost of the electricity used in their manufacture."

Using Water Power for Lighting Battery Dug-Outs in France



This French official photograph, received from the ELECTRICAL WORLD correspondent in France, shows an improvised waterwheel for generating energy to light the dug-outs of a French battery.

THE ECONOMIC VALUE OF THE SUPPLY JOBBERS

Association Decides at This Week's Hot Springs Meeting to Make Their Economic Function Clear—Co-operation with Contractors

At the regular meeting of the Electrical Supply Jobbers' Association held this week at Hot Springs, Va., the association, on the invitation of a committee from the National Association of Electrical Contractors and Dealers, voted to co-operate with the latter body in furthering the education of contractors and dealers in cost accounting and in proper merchandising methods.

CO-OPERATION WITH THE CONTRACTORS

To that end the committee of the jobbers' association on harmony in the industry recommended that jobbers having a retail business become members of the contractors' association and that they also urge all contractors and contractor-dealers to join, as well as dealers and merchants conducting retail electrical departments. In addition, a committee from the jobbers' association will attend the meeting of the contractors' association to be held in Cleveland next July.

There being a division of opinion as to what constituted retail business, which is the basis on which dues in the contractors' association are paid, that term was definitely defined by the committee in its recommendation. In general, the term as defined and accepted by the jobbers excluded sales to industrial plants.

ECONOMIC FUNCTION OF THE SUPPLY JOBBER

On the recommendation of the Atlantic division, the main body decided unanimously on Wednesday to appoint a committee to investigate all channels of publicity by which the position of the supply jobber may be strengthened in the electrical trade. The agitation against all jobbers as middlemen, which, although it has heretofore existed in a mild form, has taken more definite shape and purpose since the government itself advocated direct purchases from manufacturers, has been brought home to the consciousness of the electrical supply jobbers, and it was felt that the functions of the supply jobbers are not known, or, if known, are not properly appreciated in the electrical trade.

All middlemen are now under fire so to speak, and manufacturers are doubtful as to the proper channels to choose for the distribution of their goods. There is an unfounded suspicion that all electrical supply jobbers do is to meet every so often behind closed doors to decide upon and fix prices. Of course, those who have attended jobbers' meetings know that this is not so, but that knowledge is not so general as it might be. In addition, full advantage is not taken of jobbers' supplies by industrial plants, which, through lack of knowledge of the presence of jobbing houses in the immediate vicinity or the completeness of jobbers' stocks, order directly from manufacturers, oftentimes at a loss of time and money. To rectify this system and to set the jobber right with the trade and with the world, the association plans to embark on a campaign of educational publicity.

The appeal will be to the manufacturer as well as

to the purchaser and will dwell on the functions of the jobber which make his existence a necessity and his service of definite value to the consuming public. As an unfailing source of supplies and also as a banker in a limited sense, the jobber is already better known by the contractors than by any other branch of the electrical industry, and it is the purpose of the association to give manufacturers, owners of industrial plants and the public the same insight into the jobbing business as that possessed by the electrical contractor and dealer. An effort will be made also to impress the latter with the value of the service the jobber renders him.

It was decided to have the committee undertake this investigation at once so that it could lay its plans before the executive committee for action as soon as possible. A suitable appropriation of money is to be thereupon made to carry on the work, which will be restricted at present to the trade and trade press.

Other matters brought up for discussion on Wednesday included a system of cost accounting. Duplicating the contribution made last year, the jobbers again donated from their funds $2,000 to the American Red Cross.

Atlantic Division Jobbers Survey Conditions

At the meeting of the Atlantic division on Tuesday a general survey was made of the conditions in the electrical industry. This was both instructive and interesting. The conditions of business in the East remain fairly normal, with high spots here and there in centers where the manufacture of munitions or of other material for the war is under contract. With these exceptions no change is manifest in the demand for electrical merchandise. True, there is a falling off in the sale of devices classed as luxuries, but there is also a greater demand for labor-saving appliances due to conditions in the domestic help market.

Building operations are practically at a standstill, but activities in the industrial world more than compensate for losses in that direction. In addition government work has stimulated trade in the shipbuilding and munition centers.

A gradual change for the better is apparent in the merchandising attitude of central-station companies, and the disposition is to give wider recognition to the jobber and to the contractor-dealer as economic factors in the distribution and sale of electrical goods.

A singularly pleasant feature in the general jobbing situation is that the number of jobbing firms has not increased in the East, nor has the stability of those houses engaged in the jobbing trade been one whit weakened by war conditions. As a matter of fact, taken by and large, the jobbers are quite prosperous in the East and face the future calmly and without fear. It is felt that just as in England so in this country the claim of the jobber as a legitimate and economic entity in the distribution chain will be established more firmly than ever in spite of the feeling that the middleman should be cast into the discard as an unnecessary appendage in any meritorious scheme of merchandising.

The movement for a wider adoption of trade acceptances so far has shown but indifferent results, chiefly owing to the failure to press the scheme energetically. It is recognized that the plan is still new and that unless it is universally adopted in the jobbing trade it possesses disadvantages especially in competitive situations where delinquents have wide latitudes in choice of payments due to the varying credit practices.

On the whole, collections are good in the Atlantic district. the government and industries working for it strange to say being slowest in settling accounts. In some sections the disposition of contractor-dealers to aspire to become jobbers as well has been noted but has caused no alarm. Hardware, department and drug stores are enlarging their sales of electrical appliances, but this widening of the avenues of distribution is not an unwelcome sign, especially when the articles are handled by those conducting business on well-recognized merchandising lines.

From reports made by a Canadian jobber conditions in Canada are by no means assuring. There is a decided decline in business and merchants are husbanding all their resources. The prosperity which Canada enjoyed in 1916 and 1917 was due to the large munition orders placed by England and with the filling of those contracts prosperity ceased. Collections are difficult to make, and while no great shrinkage in values is anticipated the outlook is anything but pleasant in that country. This, however, was the only pessimistic note sounded in the meeting.

It was estimated that the jobbers have now over 50 per cent more capital tied up in stocks than before the entry of the United States in the war.

The next meeting of the Atlantic division of the Electrical Supply Jobbers' Association will be held in Cleveland at the time of the general meeting in November.

Meeting of the Central Division

Rising costs of conducting wholesale business in electrical supplies caused by (1) wage and salary increases, (2) higher costs of packing materials and shipping and delivery services, and (3) increasing amounts diverted to federal taxes, were discussed by the Central Division of the association on Tuesday.

Several jobbers reported that without increasing the number of their employees their payrolls had increased 15 per cent or more in amount during the past year, making with the increase of the previous year a total increase of more than 25 per cent since 1916.

Questionnaires answered by fifteen Middle West jobbers showed that their operating expenses for the first four months of 1918 compared with the same period of 1917 had increased by an average of 3.15 per cent, while their respective volumes of business for the same period had decreased 1.7 per cent. The jobbers' income and excess profit taxes paid during 1917 represented an average of 1.37 per cent of their gross sales and 23.7 per cent of their net profits, the figures reported showing extreme ranges of 4.7 per cent to 0.8 per cent and 6 per cent to 55 per cent respectively.

New England Section to Hold War Convention

A war convention without social features will be held in September or October this year by the New England Section of the National Electric Light Association at Springfield, Mass., the sessions occupying two days.

MISSOURI CONVENTION SHOWS A KEEN INTEREST IN RATES

Great Majority of Papers and Discussions Reflect Situation Created by Increasing Costs—Concerted Action Promised

In every sense, the convention of the Missouri Association of Public Utilities at St. Joseph, Mo., May 17 and 18, was a businesslike meeting. For the time being the central-station men of that State have ceased the discussion of the detailed problems of operation and have concentrated all thought and action on the broader and fundamental question of securing adequate net earnings. Furthermore, it is admitted that the situation in Missouri has reached a stage wherein the time for consideration of small economies that might be made in operation is past. Sweeping increases in rates are necessary to give the utilities relief. Moreover, it does not appear to the central-station executives that they are getting relief promptly enough in the present critical condition of affairs.

That the Missouri convention did have long and well-attended sessions filled with vital business discussions this year was perhaps more striking because of the contrast this convention presented to the thoroughly enjoyable convention boat trips of former years. With Hugo Wurdack of St. Louis presiding, the convention was opened by addresses from two Missouri mayors. Mayor J. C. Whitsell of St. Joseph expressed willingness to aid the local utilities in educating the public to the fact that only a small percentage of public utility company receipts are net earnings. Only a few, he said, realized that a difference exists between the money the company takes in and the net revenue. Mayor H. W. Kiel of St. Louis stated that changing conditions are making the public see the value of utility service to the city. He expressed the belief that higher rates would have to be paid for that service.

The President's Address

The address of President Bruce Cameron of St. Louis was read by Secretary F. D. Beardslee in the president's absence. The paper stated emphatically that the postponement of the convention at a time when such vital problems are to be discussed would have been a grave mistake and dealt at length on the St. Louis street-railway situation. Last February the street-railway employees demanded an increase in wages. The money to pay it could not be secured from the earnings of the company on the rates of fare in effect. Application was made for increased fare, and the city of St. Louis opposed this increase before the commission. In spite of this the commission granted the increased fare and the workmen were granted increased wages. Whether the city of St. Louis will attempt to fight still further in the courts and take the responsibility of bringing on a strike of the railway employees in consequence remains to be seen. Mr. Cameron favored the skip stop as a conservation measure both for saving coal and saving time. He predicted that prices of labor and material would reach higher levels than those now in effect and pointed out that high prices would continue for a long while still, even should the war be ended. His recommendation was that changes be made to take these things into account. As one of these changes he suggested the coinage of a 7½-cent piece to take the place of the 5-cent piece, the purchasing power of which is no longer sufficient to secure the formerly common 5-cent commodities.

J. S. Tritle, manager of the St. Louis office of the Westinghouse Electric & Manufacturing Company, in a paper on "How the Manufacturer Is Meeting the Problems Created by War," recited data on the increased business which his company is doing. On June 30, 1914, the company employed 11,702 men, and on Feb. 28, 1918, it had 36,534. When war broke out Aug. 1, 1914, the company had on its books unfilled orders amounting to $8,000,000; on April 1, 1918, unfilled orders amounted to $153,000,000, not including gun business of the New England Westinghouse Company.

Public Utilities' Rates and Revenues

The paper by H. Spoehrer of St. Louis on "Taxes Affecting Public Utilities" indicated one broad and ever-widening avenue through which revenues of public utilities are taken from them. Especial attention was directed to such discriminatory taxes as the franchise tax and the gross income tax not assessed against other industries. The author named a total of twenty-one separate taxes and gave the total of each paid by the Union Electric Light & Power Company. In the aggregate these taxes amount to 12 per cent of the average price per kilowatt-hour.

Col. Philip J. Kealy of Kansas City presented a paper which was one of the most important. It sounded the keynote of the convention in the following words:

"We are here to work out plans not to reduce operating costs or to effect small economies, but plans to preserve the very existence of the industry itself. One of the principal things we now have to do is to effect that change in our own psychological attitude that we must later effect in that of the general public. We must get away from our local viewpoint with all its prejudices and face our problem as a national emergency. We must, in our own minds and in the minds of the public we serve, stamp our companies with a national character and have them considered as a vital and essential part of our war preparations."

In addition to this, the paper was a résumé of what has been accomplished nationally on this line and was an outline of what the Missouri association can do to help carry on the national movement. Not the least part of this program consisted of work to prepare the public mind for rate increases which the companies must have and which commissions are willing to grant when shown the facts.

Discussion of this paper brought out that this work of public education must be done by newspaper advertising, by personal explanation among influential citizens, and by all other available means of disseminating information. The question of how to answer the argument of the man who says a utility should not break rate contracts, even though it be losing money, also came up. Several good answers were suggested. One form of explanation was that public utility contracts are long-term contracts as compared with ordinary commercial obligations. They are based on years of experience in normal times. Now times are very abnormal. The public utilities are giving service at a loss. A contract that is being fulfilled at a loss is sure to be expensive to the party served in the long run. An inferior service will be delivered or some other trouble will develop. It is better for both parties to

readjust the contract to profitable terms. Another argument advanced was that the public did not object to breaking public utility rate contracts as long as the break was in its favor. Then, why should it object to the same procedure when the break favors the company?

THE WAR AND THE UTILITIES

The paper by H. Wurdack of St. Louis on "The Effect of War Upon Utilities" was an analysis of statistics from Moody's and Poor's manuals and of conditions as they have been observed. The author concluded from his analysis that: (1) Regulation will only be tolerated by the American people as long as it seems to work to their advantage; (2) laws and limitations made in peace times to govern peace conditions are in many cases found to be wholly inadequate, improper and inoperative in a war emergency, and (3) commissions, local authorities and communities must allow liberal and speedy remedy if total destruction of utilities is to be averted.

He also suggested as remedies that rates should be increased enough to reimburse companies for losses already sustained and enough to prevent further losses, and recommended that unnecessary capital expenditures be curtailed to the limit and some means be provided for financing necessary work at reasonable capital costs.

As a fitting culmination of these papers and this discussion on rates and revenue, the resolutions committee submitted a previously planned and carefully drawn resolution which the association, acting as a committee of the whole, will later present to the Missouri commission. The purport of resolution follows:

That all public utilities are entitled to increases in rates sufficient to cover increased costs and that new or changed schedules of rates should be allowed to take effect and should not be suspended by the commission until an adverse showing has been made to justify suspension. Furthermore, the resolution declared that all operating costs incurred by franchise requirements not essential to the maintenance of service should be discontinued for the duration of the war. The resolution was aimed particularly at the present practice of the commission of suspending all applications for increases in rates instead of permitting them to become effective by law thirty days after filing.

THE COAL PROBLEM

Gov. Wallace Crossley, Fuel Administrator for Missouri, being in the city on other business, addressed the convention extemporaneously. He predicted more serious coal troubles next winter than prevailed last winter. He expressed the opinion that the activities of the national fuel and transportation departments should be co-ordinated. In the discussion following his talk many central-station operators testified that the grade of coal now being delivered from mines was twice as high in ash as formerly and estimated that a saving of 30 per cent in coal cars could be made by compelling mines to ship clean coal. A committee is to be appointed to supply Governor Crossley with accurate data on the inferior coal service now being rendered to Missouri utilities.

M. F. Henry, secretary of the Missouri Fuel Administration, in a paper told the delegates that higher freight rates on coal amounting to 15 cents to 50 cents a ton could probably be expected within six weeks. He also spoke of the national Fuel Administration's plan for classifying power plants in order to shut down inefficient isolated plants. The inefficient plants in Missouri, he said, will soon find their fuel supply cut off.

In the discussion the opinion was expressed that the Fuel Administration could do more good by regulating the quality of coal than by concerning itself with stopping small leaks in central-station plants.

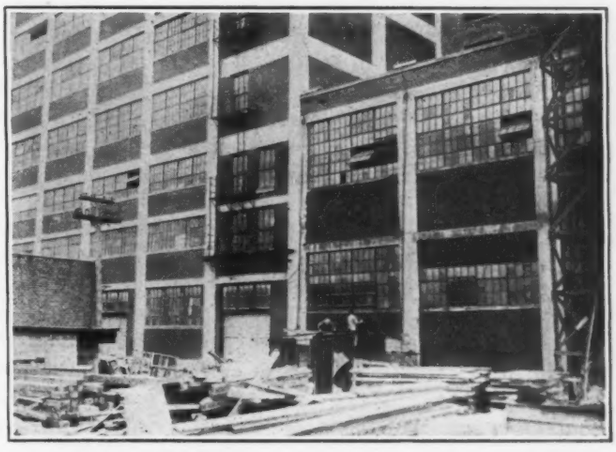
Others who took part in the convention program were Prof. H. C. Lanier of the University of Missouri and J. A. Whitlow, engineer with the Missouri Public Service Commission.

Mr. Whitlow declared the commission had been requiring extensive publicity on the details of all rate increases granted before entering a decision, in order to maintain favorable public relations for the companies. Concerning rates of return, he said there were some good reasons why higher returns should be granted now. With the small electric utilities—that is, those in towns of 1000 or less—he said operating costs are now 18 cents to 20 cents per kilowatt-hour. He predicted that some of these will have to be shut down for the period of the war, as they could not sell their product at a price which would even sustain the property.

ELECTION OF OFFICERS

Officers elected for the ensuing year are: President, J. H. Van Brunt, St. Joseph; first vice-president, J. M. Scott, Kansas City; second vice-president, L. P. Andrews, Sedalia; third vice-president, H. Spoehrer, St. Louis, and secretary-treasurer, F. D. Beardslee, St. Louis. The executive committee is composed of P. J. Kealy, Kansas City, and B. C. Adams, Joplin, and the public affairs committee comprises V. L. Elbert, St. Joseph; J. F. Porter, Kansas City; Bruce Cameron, St. Louis, and E. C. Deal, Springfield.

How Electric Energy Helps to Conserve Wheat



Electricity helps conserve wheat. The new building in the middle of the picture is a 7000-kw. substation at the Cedar Rapids mill of the Quaker Oats Company, which receives power from the Iowa Railway & Light Company. Electricity here turns the wheels of what is said to be the largest cereal mill in the world, and produces more than 1,000,000 wheatless breakfasts daily.

Women Employees Are Helping Too

These employees of the New York Edison Company, Bronx district, took part in the third Liberty loan parade and are actively working for the Red Cross and a performance of "Fancy Free" to be given on the evening of May 28 at the Casino Theater, the entire proceeds of which will go to the Red Cross auxiliary of the New York lighting companies.

SOUTH DAKOTA ASSOCIATION MEETING AT SIOUX CITY

Discussion on the Electric Range as an Agency for Fuel Conservation Brings Out Interesting Points

The second annual convention of the South Dakota Electric Power Association was held at the Carpenter Hotel, Sioux Falls, on May 15 and 16. An address of welcome was made by R. D. Springer, secretary of the Sioux Falls Commercial Club.

H. F. Brownell, president of the Sioux Falls Rotary Club, gave a paper on "Service," in which he pointed out that in every business it should be the aim to render service to the purchaser. "Service" was defined as that part of the commodity which is not paid for but which must be rendered in order to build up a successful business.

In his paper on "Electric Ranges and Ovens," H. Hamilton Jones of the Hughes Division of the Edison Electric Appliance Company pointed out that it is the patriotic duty of every central-station manager to push the sale of electric ranges and ovens as a means of conserving the coal and meat supply and thus helping to win the war.

The following important facts were brought out by the discussion: A rate of 4 cents or 4½ cents per kilowatt-hour is not a prohibitive rate. The station peak is not materially increased by the installation of electric ranges. An effort should be made to place the first ranges in a town in the homes of people of moderate means where the mistress uses the range herself, rather than in homes of the wealthier people where a maid does the cooking. The big disadvantage of the electric range is the cost of heating water.

The "Question Box" brought about the discussion of the following subjects: The necessity for increasing rates, especially in the smaller steam plants; transmission-line problems—use of iron wire, lightning troubles, farmer consumers; the advisability of trying to get a public utility law passed.

The time and place of the next convention were left for the executive committee to decide. The following officers were elected: President, A. H. Savage, Flandreau; first vice-president, E. J. Sherwood, Mitchell; second vice-president, L. V. Schneider, Salem; secretary-treasurer, O. J. Gronsdahl, Hartford; executive committee, W. C. Blanchard of Aberdeen, F. D. Brown of Huron and N. C. Draper of Sioux Falls.

PROGRAM ARRANGED FOR THE N. E. L. A. CONVENTION

Tentative Outline of Business for the War Meeting Which Is to Be Held at Atlantic City, N. J., on June 13 and 14

The tentative program for the convention of the National Electric Light Association at Atlantic City on June 13 and 14 follows:

Thursday Morning, June 13—Presidential address; reports of secretary, treasurer, membership committee; reports Commercial, Technical, Accounting and Electric Vehicle Sections; new business.

Thursday Afternoon—Report of National Committee on Gas and Electric Service; report of committee on public utility conditions—war financing of utilities, rate increase activities, etc.; report of public policy committee; discussion of central-station aspects of the labor problem; female employment; meter reading and testing; economized accounting.

Thursday Evening—Patriotic addresses on the broader national topics of immediate importance to the industry, by distinguished speakers (details in the hands of the president).

Friday Morning, June 14—Address and general discussion on the coal situation; important war-time topics introduced by the Technical and Hydroelectric Section.

Friday Afternoon—Important war-time topics introduced by the Commercial, Accounting and Electric Vehicle Sections.

Friday Evening—Round-table discussions and films of war activities of special interest to member companies, with other appropriate features.

A circular letter issued to members by Secretary T. C. Martin displays prominently the announcement that "no ladies are expected in attendance, and there will be no provision for entertainment."

The hotel reservations are in the hands of Frank W. Smith of the convention committee. It is confidently expected that ample accommodations for all delegates in attendance will be provided at the Traymore, where the convention will be held. Hotel reservations should be made immediately through the hotel committee, addressed to Mr. Smith, 130 East Fifteenth Street, New York. The committee will be glad to provide any detailed information required and will promptly advise the delegates as to the reservations. Those desiring to secure accommodations at other hotels will have their wants promptly cared for by the committee, on application, which should also be addressed to Mr. Smith. Should such information be required, the official circular of the Atlantic City Hotel Men's Association, listing some forty hotels, will be sent on request.

As soon as definite information from the membership is in the hands of the convention committee steps will be taken by it to insure as far as possible a sufficiency of parlor-car accommodation from New York and Philadelphia and homeward.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

New York Jovian League.—At a luncheon on May 15 Frank Dixon, Red Cross Commissioner to France, talked on "My Personal Experiences in France" before the New York Jovian League. On June 15 the league will hold its summer rejuvenation at the Hotel Shelburne, Brighton Beach, N. Y.

Electrical Club of Detroit.—Dr. E. J. O'Brien, who recently returned from active service in France to Base Hospital No. 17, talked before the Electrical Club of Detroit at the regular luncheon of May 11. William S. Gilbreath, secretary and manager Detroit Automobile Club, addressed the Electrical Club on May 18.

Iowa Association of Electrical Contractors and Dealers.—At the annual meeting of the Iowa Association of Electrical Contractors and Dealers J. E. Sweeney of Waterloo was elected state chairman, and J. N. Holoway of Mason City was elected treasurer. This meeting was held at Fort Dodge on April 30 and 31.

A. I. E. E, Schenectady Section.—Prof. Comfort A. Adams, president of the A. I. E. E. and professor of electrical engineering at the Massachusetts Institute of Technology, was the main speaker at the annual meeting and dinner of the Schenectady Section of the American Institute of Electrical Engineers on May 24.

N. E. L. A., Philadelphia Company Section.—William K. Kerford was elected chairman of the Philadelphia Electric Company Section of the National Electric Light Association at a meeting on May 15. Major William M. L. Coplin, director of Base Hospital No. 38, spoke on "From the Trench to the Base Hospital."

Massachusetts State Association of Contractors and Dealers.—On May 9 the Worcester district of the Massachusetts State Association of Electrical Contractors and Dealers transferred its meeting place from Worcester to Fitchburg. Representatives of the Westinghouse Electric & Manufacturing Company and the Worcester Electric Light Company were present and addressed the meeting.

Electrical League of Cleveland.—The Electrical League of Cleveland participated in the big Red Cross parade held on May 18. On May 20 mobilization was completed for organization of the league in the competition for the "victory chest" to be donated to the organization securing the largest amount of subscriptions for the Red Cross in Cleveland. Lieut. John H. Clark spoke to the league on navy expansion on May 9.

New York Electrical Society.—The three hundred and sixty-fifth meeting of the New York Electrical Society was held on May 23. V. T. Goggin gave an illustrated lecture on how Camp Devens was constructed.

N. E. L. A., Brooklyn Company Section.—On May 7 A. E. Muenich presented a paper entitled "Street-Lighting Engineering and Construction" before the Brooklyn Company Section of the National Electric Light Association.

Jovian Electric League, Los Angeles.—At the May 15 meeting of this league H. Hinkovic, a former member of the Croatian Parliament and member of the Jugoslav committee of London, spoke on the subject of European politics and racial differences.

I. E. S., New England Section.—At the last meeting of the season of the New England Section of the Illuminating Engineering Society Edmund Leigh, chief of plant protection, Military Intelligence Bureau, Washington, D. C., delivered a talk on "Plant Protection," and M. Luckiesh of Nela Park, Cleveland, Ohio, talked on "Timely Aspects of Lighting." This meeting was held on May 21.

The Engineering Foundation. — A special meeting of the Engineering Foundation will be held on May 28 at 8.30 p. m., in the auditorium of the Engineering Societies Building in New York. Dr. George E. Hale will address the meeting on the "National Research Council." The foundation is composed of representatives of the national societies of Civil, Mining, Mechanical and Electrical Engineers.

Association of Iron and Steel Electrical Engineers.—Two hundred and nineteen members of the Cleveland, Youngstown and Pittsburgh sections of the Association of Iron and Steel Electrical Engineers inspected the Ohio and McDonald plants of the Carnegie Steel Company on May 18. The two bar mills of the latter plant recently put into operation were viewed. B. W. Gilson, chief electrical engineer of the Carnegie Steel Company and vice-president of the association, was host to the big delegation of visitors. The meeting concluded with a dinner at the Ohio Hotel in the evening and a discussion of the day's trip through the local mills.

Western Society of Engineers of Chicago.—Preparation by American engineers for leadership in the coming industrial development of Russia is urged by the Russian Society of Engineers of Chicago. A series of lectures by Russian and American engineers on the industrial needs of Russia and the mutual benefits to be derived by commercial intercourse is being arranged for all Chicago engineers by the Western Society of Engineers. The first meeting was scheduled to be held at the rooms of the Western Society of Engineers, Chicago, on May 22, with addresses by William J. H. Strong, consulting engineer, on the industrial development of America and similar possibilities in Russia, and by W. W. De Berard, Western editor *Engineering News-Record*, on publicity.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Sale of Municipal Plant Administrative Action.—Mandamus will not lie to compel the mayor of a city to file referendum petitions and call an election thereon for the purpose of referring to the people of said city the action of the city council in ordering a sale of its electric light plant pursuant to the Revised Laws 1910, 541, giving the city the right to dispose of its real property, as such action involves administrative discretion and is not within the referendum powers reserved to the people of municipalities, the Supreme Court of Oklahoma held (170 P. 1165).

Utility Cannot Contract to Release Itself Arbitrarily from Contracts.—A corporation assuming the performance of a public duty to domestic consumers, as the furnishing of electricity for light, may make and enforce reasonable rules and regulations for the conduct of its business, but it cannot compel its patrons to enter into contracts releasing it from its obligations when and as it may arbitrarily elect, but must to extent of their needs and within the limits of facilities serve alike those accessible thereto who apply therefor and submit to such rules and regulations, according to the Supreme Court of Appeals of West Virginia in Chambers vs. Spruce Lighting Company (95 S.E. 192).

Injunction to Stop Further Progress of Municipal Project Diverting Water.—The riparian rights of a power company, consisting of a small parcel of land extending to high-water mark below a dam and reservoir constructed by a city for water-supply purposes, a contract with a riparian owner below the dam for a portion of the riverbed with a right to regulate flowage, and options for other lands and rights, all of which were apparently acquired after the city's water development was practically completed, did not entitle such company to relief by injunction against the further construction of the dam and reservoir and the diversion of water, the United States Supreme Court held (38 S.C.R. 245). If a city's development of the water of a river for a water supply was unauthorized, its act in damming the river and diverting the water was that of an ordinary wrongdoer, and a power company owning riparian lands and rights and which had adopted a plan of development had only the usual remedy for a tort by an action at law for damages unless exceptional circumstances rendered resort to a court of equity appropriate, which was not the case where the company could not for the present be injured and might never be substantially affected by the diversion of the water.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Saving Energy at Cleveland.—On the new bridge across the Cuyahoga River at Superior Avenue, Cleveland, 100 of the 1500-cp. lamps are to be replaced by 1000-cp. lamps in order to conserve energy.

First Coal Over Government Railroad in Alaska.—The first commercial shipment of coal from the mine operated by the Alaskan Engineering Commission was made in the last week of April. A consignment of 100 tons from the Chickaloon field went to Seattle, Wash., on the steamship Alameda. The coal was shipped in sacks under a freight rate of $5 per ton for shipments of 100 tons or more and $7.50 per ton on shipments less than 100 tons.

Power Survey at Denver.—The electrical bureau of the Civic and Commercial Association of Denver is making a complete survey of all the power plants in the city with the idea of effecting fuel economy. A dozen enumerators employed by the bureau are engaged in obtaining data concerning all plants rated at more than 5 hp. The next step planned by the bureau is to offer free engineering advice to the proprietor of each power plant, in the interest of saving power or fuel.

Daylight Saving Reduces Revenue.—The San Joaquin Light & Power Company has applied to the California Railroad Commission for an increase in rates, testifying in support of the claim that the daylight-saving law will reduce its revenue $50,993 for the year. The company asks a rate increase so that it may earn 8 per cent on its investment. Owing to water shortage and fuel prices the company claims that its fuel cost this year will be far in excess of last year's costs.

Training School for Replacement Troops of Engineer Corps.—The government is to establish immediately at Camp Humphreys, Va., a training school for replacement troops of the Engineer Corps. These men will have intensive training to fit them for special service in connection with the engineer units in the service. There will be a complete school, in which all the trades identified with the engineer units of the army will be taught by means of short intensive courses. As this school will have room ultimately for approximately 30,000 men, many instructors will be required, and an appeal is made to qualified men beyond the draft age to enlist in the Engineer Corps as instructors. A thorough knowledge of the trades followed by machinists, blacksmiths, wheelwrights, carpenters, concrete foremen, electricians, dynamo experts, miners, painters, riggers, sheet-metal workers, foundrymen, automobile and motor truck makers, gas-engine men, draftsmen, photographers and foremen of construction is required, and the applicant must furnish credentials showing knowledge of one of these lines. Full particulars and application blanks will be furnished by Captain Louis T. Grant, E. R. C., secretary Engineer Training Schools, Camp Humphreys, Va.

Study of Bituminous Coal Storage.—The engineering experiment station of the University of Illinois has just completed a study of the problems involved in coal storage and has published the results in a 200-page illustrated book designated as Circular No. 6, "Storage of Bituminous Coal." The study was made under the direction of H. H. Stoek, professor of mining engineering. The reasons and advantages of storing coal are given, the kinds and sizes of coal which may be safely stored are described, and the many factors entering into successful storage are discussed. Copies of Circular No. 6 may be had by addressing the engineering experiment station at Urbana, Ill. The price is 40 cents per copy.

Thrift and Economy a Duty. — The Council of National Defense and the advisory commission to the council believe that a concerted effort for economy by the people of the nation will not only go far toward paying America's expenses in the war, but will also reduce consumption of raw and manufactured materials essential to the conduct of the war. The council urges all to refrain from unnecessary expenditure of every kind and to bear constantly in mind that only one thing is now of real importance, and that is the winning of the war. This war is more than a conflict between armies; it is a contest in which every man, woman and child can and should render assistance. Thrift and economy are not only a patriotic privilege but also a duty, the council adds.

Rate Case in Columbus, Ohio.—To decide a dispute between the city of Columbus and the Columbus Railway, Power & Light Company as to the justice of a rate for domestic lighting fixed by the City Council, Ohio Public Utilities Commission engineers have made an appraisal of the property used for light and power service. It was figured that the reproductive value is $6,240,046, as compared with $7,105,808, the valuation found by company appraisers. Present value is given as $5,725,963. It is said that the city will endeavor to secure a reduction in the valuation. The ordinance rate was placed at 5 cents on Dec. 27, 1915. The company contended that this was too low and appealed to the commission. The city then asked appraisal. A hearing will be held by the commission later. For some time the company has been endeavoring to secure an amendment to its franchise which would allow an increase in the street-railway fare. The council refused the request for this change, and since then the company has been employing publicity to urge the necessity for proper compensation as a relief from war conditions.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Free Service.—In deciding a complaint of the town of Sigel against the Central Illinois Public Service Company, the Illinois Public Utilities Commission says that where the terms of a franchise ordinance granted subsequent to the enactment of the utilities act provided in good faith that the town should receive the same free service as surrounding communities the commission, expressly denying establishment of a precedent, authorized the utility to continue rendering free service in compliance with the terms of such ordinance.

Direct-Current Service.—Acting on a petition of the Monmouth Public Service Company, the Illinois Public Utilities Commission has decided to approve rates for direct-current electric power service approximately 10 per cent higher than charges for alternating-current power service. The commission would not consider the question of discontinuance of service on a petition to increase rates for such service. A rate schedule for direct-current power service will not be approved, the commission held, where it appears that the schedule is intended to make the rates intolerably high for the purpose of forcing its discontinuance.

Bond Sale Authorized in California.—The California Railroad Commission has issued an order authorizing the Sierra & San Francisco Power Company to issue $1,000,000 of its first mortgage 5 per cent forty-year gold bonds, payable Aug. 1, 1949. The order of the commission permits the company to sell the bonds at not less than 80 per cent of their face value plus accrued interest, and provides that the bonds shall be used by the company to reimburse its treasury in part for capital moneys expended for improvements prior to Feb. 8, 1918. After such reimbursement, all funds obtained through the issue of the bonds shall be expended only for such purposes as the commission may authorize in a supplemental order or orders. In its decision the commission suggests that the company proceed with the construction of substations, distribution lines and other improvements estimated by the company to cost $197,344.31. The commission further recommends that the company expend approximately $150,000 for the construction of a third penstock to its existing Stanislaus plant and $450,000 for the installation of a 5000-kw. unit at its so-called Upper Stanislaus plant. It is estimated that the installation of the third penstock will increase the company's generating capacity by 3200 kw., while the expenditure of $450,000 on the upper Stanislaus plant will add 5000 kw.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Henry L. Doherty was recently given the degree of doctor of laws at the commencement of Lincoln Memorial University at Cumberland Gap, Tenn.

E. L. Munger, who has been superintendent of the Gloucester (Mass.) Electric Company for the last twenty-three years, has been promoted to the position of general manager of the company.

George E. Haggas has been appointed assistant to the general manager of the Cumberland County Power & Light Company, Portland, Me. Mr. Haggas has been connected with the company since 1915, when he was engaged to do valuation work in the engineering department. He is a graduate of the University of Michigan.

J. I. Banash, for eleven years actively engaged as engineer at the Underwriters' Laboratories, Inc., in the examination and testing of hazardous appliances, has been appointed engineer-in-charge of the casualty department. He succeeds S. V. James, who is now mechanical engineer on special research work at the laboratories.

John D. Ball, professor of electrical engineering at the School of Engineering of Milwaukee, has been appointed dean of the school to succeed Prof. William Baum, resigned. Professor Ball was a graduate of the University of Illinois and went to the School of Engineering about a year ago from the General Electric Company, with which he had been connected for about ten years.

W. Irving Mellen, commercial manager of the New England Telephone & Telegraph Company, Pittsfield, Mass., has resigned to become sales manager of the Pittsfield Electric Company June 1, succeeding H. W. Derry. Mr. Mellen has been in the employ of the New England company for about eighteen years, seven of which were spent at Springfield, Mass., and eleven at Pittsfield.

William Baum, who has been dean of the School of Engineering of Milwaukee for the last two years, has resigned to become research engineer for the Milwaukee Electric Railway & Light Company, which office has been newly created. Prior to his educational work, Professor Baum was connected with the General Electric Company for fourteen years, during three years of which he was the company's foreign representative.

Robert L. Brunet, for the last five years public service engineer of the city of Providence, R. I., has resigned to become industrial and efficiency engineer of the Jenckes Spinning Company, Pawtucket, R. I. He expects to leave his present post June 15. Mr. Brunet was formerly power engineer of the Essex Division, Public Service Corporation of New Jersey, and earlier was in the employ of the General Electric Company at Schenectady, N. Y. In his work at Providence Mr. Brunet has ably represented the city in connection with public utility rate changes, service standards and various franchise and operating matters.

Obituary

Prof. F. R. Hutton, past-president of the American Society of Mechanical Engineers, died on May 14 at the age of sixty-five years. Professor Hutton was graduated from the School of Mines, Columbia University, 1876. A year later he was appointed instructor in mechanical engineering as an associate of the late Prof. W. P. Trowbridge. He entered the faculty as adjunct professor in 1881 and became professor in 1890. Upon the death of Professor Trowbridge in 1892 the chair of engineering which he occupied was divided, and professorships in civil engineering and electrical engineering were added to

F. R. HUTTON

the already existing professorships of mining and mechanical engineering. Professor Hutton was made head of the mechanical department. He continued to direct this department until his resignation, July 1, 1907. At this time he resigned and was elected professor emeritus. For six years during his professorship he was dean of the faculty of applied science. Columbia conferred upon Professor Hutton in 1882 the degree of Ph.D. and in 1904 the degree of Sc.D. He became secretary of the American Society of Mechanical Engineers in 1883, three years after its organization. Professor Hutton was the member appointed by the society to the conference and building committee of the United Engineering Society. This committee was organized to plan the new Engineering Societies Building at 29 West Thirty-ninth Street. Professor Hutton was also one of the board of trustees which is the holding corporation for the United Engineering Society. He declined re-election to the office of secretary in January, 1906, and at the annual meeting in the following December was unanimously elected president. In addition to these activities he was a contributor to scientific literature. His most important books, which have received considerable acceptance in the educational field in the United States and in England, are "The Mechanical Engineering of Power Plants" (in later editions, "The Mechanical Engineering of Steam Power Plants"), "Heat and Heat Engines" and "The Gas Engine." He did considerable editorial work as associate editor of Johnson's Encyclopedia, as one of the editors of scientific and engineering titles for the Century Dictionary, as departmental editor of the *Engineering Magazine*, and as a contributor to technical journals and a lecturer to scientific and popular audiences in New York and elsewhere. At the close of Professor Hutton's administration as president he was appointed by the council to the office of honorary secretary.

Samuel D. Binkowitz, Chicago manager of the Illinois Wire & Cable Company, died at his home on April 25.

F. E. Getts, manager of the Electrical Engineers' Equipment Company, Chicago, died recently at Los Angeles, Cal.

Duncan H. Graff of the sales department of the American Carbon & Battery Works, East St. Louis, Ill., died on May 7.

Charles S. Powell, an electrical engineer, died at his home, Cleveland, Ohio, on May 11. Mr. Powell was for some years Cleveland representative of the Westinghouse Electric & Manufacturing Company. In 1902 he was sent to London, where he assisted in establishing a branch office of the company. A few years ago he returned to Cleveland and engaged in the electrical engineering profession.

Winfield Scott Chaplin, a noted teacher of technology, died recently at the age of nearly seventy years. Mr. Chaplin was a graduate of West Point, but he served in the army only a short time. In 1873 he was appointed professor of mechanical engineering in Maine State College and four years later became professor of engineering in the Imperial University of Japan, where he remained until 1882. On his return to America in 1883 he took a chair at Union College, and in 1886 he went to Harvard University, where for five years he served in the double capacity of professor of engineering and dean of the Lawrence Scientific School. In 1891 he became chancellor of Washington University, where he remained until 1907, when he retired from active work. Professor Chaplin won a wide recognition for his educational work, and among the distinctions which he received was the degree of doctor of laws, conferred on him by Harvard University, that of doctor of technology, by the University of Japan, and the Order of the Rising Sun, by the Emperor of Japan. He had a wide affiliation with technical societies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

PORTABLE ELECTRIC TOOLS OFFER JOBBERS MORE PROFIT

Grinders, Drills and Similar Articles Can Be Sold by Present Force to Trade Already Called On, with Resulting Profit to Jobber and Manufacturer

In an analysis of their relations with their distributers, manufacturers of portable electric tools may be divided into two classes, namely, those who have their own complete sales force and those who sell through agents. Generally speaking, those who have their own sales force are concerns whose primary business is pneumatic rather than electric tools. The development of electric tools followed pneumatic tools, and the new line was simply dumped on the old sales force with orders to "go to it." Those who do distribute through their own sales force claim to do so for the advantage it gives them of keeping the entire business in their own hands. This group in the industry, however, is not strongly sold on its own plan. Were it not for the fact that they are loaded up for months ahead with war business, they would listen now to a plan for changing and broadening their lines of distribution. Some of them are thinking very strongly about it even now.

Of the group which is selling through agents not many are taking advantage of the established lines of distribution within the electric trade. They are not using the electrical jobber with his large sales forces in daily touch with the important industrial plants of the nation. One reason for this is that there was an easily reachable and perfectly legitimate channel through which a certain volume of business could be built in the existing machine-tool sales field. Machine-tool dealers in this field were prepared to handle portable electric tools and to sell some of them. The manufacturers have therefore gone after business through these dealers with some success. On the other hand, the electrical jobber was not found to be in a particularly receptive mood by the manufacturer of portable electric tools, because to induce him to take up a new line he must be imbued with the idea that his men could handle it at a profit. None the less, the jobber can be reached, in some instances has been reached, by certain manufacturers, as is indicated by the following testimony from a manufacturer of portable grinders. He said: "Electrical jobbers should be selling our grinders for several reasons:

"1. There is a good big percentage of profit in each sale made.

"2. There is a good demand for these tools among industrial plants, navy yards, arsenals, etc.

"3. The grinders are absolutely reliable and when sold stay sold.

"4. The tools are light and portable, and jobbers' salesmen calling on industrial plants can very readily carry the grinders with them, demonstrating them to the prospective buyer right in his own plant. The salesmen already have entree to these plants.

"5. The product gives jobbers' salesmen an opportunity to call on purchasing agents, master mechanics, etc., presenting something new to them and also putting before these men equipment that will mean more efficient production in their various departments.

"Where jobbers have really become interested in the sale of our grinders they have been able to do a very satisfactory business with them.

"After seeing how readily the grinders could be sold, a Hartford jobber instructed his men to push them, with the result that in three months following they had sold 109 grinders. What they have been able to do other electrical jobbers should be able to do."

That many incidents like this one in the grinder field have not been reported from the portable-drill and other small tool fields is probably due to a lack of appreciation of the mutual advantage these two groups could be to each other. The great advantage to the manufacturer would be better distribution. Broader distribution would mean to him not only more stable business but greater volume and a faster turnover. For the jobber the advantage would be more profit. His sales forces are calling on industrial plants to sell supplies as it is, and might just as well introduce a few portable tools. These carry an increased margin of profit that will act to raise the total gross profit on industrial business without increasing the sales expense. With a profit of from $20 to $50 per tool for the jobber, every sale is worth while. It seems probable that the enterprising jobbers looking for lines to sustain the business already impaired by lack of domestic building activities will investigate this line more closely in the near future.

INCANDESCENT-LAMP FACTORIES ARE ACCUMULATING STOCK

Buyers Are Being Urged to Estimate Fall and Winter Needs—Shortage in Supply Is Not Unlikely

Just how much the observance of the so-called daylight saving law is affecting the sale of incandescent lamps has not been determined. Experts are making estimates and, roughly speaking, it is believed that from 5,000,000 to 10,000,000 fewer lamps a year will be sold. With an annual production of about 210,000,000 lamps, these figures, in comparison, may not look formidable; but, nevertheless, they constitute quite an item. The demand for lamps has fallen off, as it always does, with the lengthening days and approach of summer.

Manufacturers now say they are accumulating a good stock in all their plants in nearly every size. The production of miniature lamps, which ran behind alarmingly during last fall and winter, while still not normal, is being much increased. The floodlamp situation, at one time acute, is improving. The stock of standard sizes for electric railway cars is in good shape. Some factories admit that on account of extra buying pressure locally certain sizes are still short, but they say that conditions are bettering.

The government's initial orders for cantonments, hospital and naval bases, war ships and munition plants, particularly in the East, have been about filled. This drain has caused a shortage everywhere. Heavy renewal requisitions, however, are expected, and for these the producers are to a great extent well prepared.

What the manufacturers, some of whom are launching an educational campaign on the subject, desire the trade to understand is that within the next few weeks—no later than June, they say—buyers should give earnest attention to placing orders for their fall and winter requirements. This is because war conditions are radically different in every aspect from normal times. The traffic situation will be more congested, and another shortage similar to that of last fall may occur. The productive capacity of the plants has not been lessened, and the output is directed to strengthening district stocks. Deliveries are interfered with by embargoes, but are improving. Labor is also uncertain, which has a tendency to lessen production. Orders for lamps of unusual design or construction are given short shrift. This policy is followed to prevent any curtailment in the output of regular lines.

JOBBER STOCK PROBLEM OF THE COMING MONTHS

More Frequent Ordering than in the Past May Become the Rule Owing to the General Delivery Situation

In the coming months more judgment will be needed by jobbers in placing stock orders than ever before. While there are price increases every now and then, generally speaking they are not large. In fact, for some months the price of electrical staples on the whole has been remarkably steady for these times. There is every indication, therefore, that so far as electrical supplies are concerned the peak has virtually been reached.

While there is no immediate prospect of a decline, the natural sequence to a prolonged advance in price is lower prices. There is no such thing as missing that phase. The far-sighted men are, however, making careful effort to minimize its effect.

Certainly this is not the time to speculate. There are too many elements in favor of more conservative action. On the other hand, this is no time for a jobber to let his stock run low. The government and other buyers need the jobber and his stock. Therefore stock must be kept ful regardless of the prevailing price. Over-stocks must be avoided not only because of the speculative troubles but because too much stock should not be tied up indefinitely in an inactive condition when others are clamoring for these goods.

While, of course, the value of purchasing in large quantities must not be lost sight of or underrated, nevertheless it must also be borne in mind that the most important factor at present is not price but delivery. Consequently it is not improbable that the policy of more frequent ordering to replenish stock will become more general. A string of orders would seem to present a greater chance of delivery of some material, an order here and there, than a smaller number of orders each of larger size.

METAL MARKET SITUATION

Government's Attitude Toward Increase in Price of Copper Not Disclosed—Tin Short

Whether the copper producers and refiners have abandoned their attitude toward an increase in the government price of the metal has not been disclosed. On June 1 the present figure of 23.50 cents a pound expires by limitation. The so-called "insiders" are not talking for publication, and covered wire and cable manufacturers no longer speak of an increase in the price of their products.

No arrangements have been effected for the equitable distribution of tin as between war material demands and commercial uses. The metal is decidedly short and prices nominal, but ruling high. The War Industries Board has commandeered all stocks of platinum, allowing $105 per Troy ounce on purchases. Fluctuations in the quotations on old metals are negligible.

NEW YORK METAL MARKET PRICES

	May 13	May 20
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25 to 26.75	26.25 to 26.75
Lead, trust price	7.00	7.00
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt price 15.00	Govt. price 15.00
Spelter, spot	7.45 to 7.57½	7.50
Tin, Chinese*	$1.05	$1.03
Aluminum, 98 to 99 per cent.	Govt. price †32.10	Govt. price †32.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 13.75	13.50 to 13.75
Brass, light	10 50 to 11.00	10.50 to 11.00
Lead, heavy	5.75 to 6.00	6.00 to 6.25
Zinc, old scrap	5.00 to 5.50	5.25 to 5.75

*No Straits offering. †In 50-ton lots; carloads, 32.10 cents per lb.; 10-ton to 14-ton lots, 32.20 cents per lb.

THE WEEK IN TRADE

GOVERNMENTAL orders for electrical equipment, accessories and supplies of every description are making the highest sales records in the history of the trade. Manufacturers, jobbers and dealers are participating in current prosperous conditions, according to their capacity and facilities.

An increased demand is reported for small and medium-size motors, with stocks lower. Storage batteries are selling rapidly, with the supply diminishing. Domestic appliances are having a sale far above that of last year. Conduit of all sizes is scarce in the East and South but in a better position in the Far West. A shortage of labor is said to be affecting many lines of electrical manufacturing. Deliveries have been more prompt in some sections, especially in the Middle West and Northwest. But along the Atlantic seaboard freight embargoes are yet restricting trade.

Collections are reported better—fair to prompt. Credits are being limited on outstanding accounts for special reasons.

NEW YORK

Outside of government orders trade with jobbers, distributers, producers and dealers is referred to as quite satisfactory. The sale of electrical goods and equipment is on a much larger scale than a year ago; in fact, some jobbers state that their business has more than doubled. One well-known manufacturing jobber, in a formal financial statement, reports sales for the four months ended April 30 of nearly $1,750,000. The concern's gross business in 1917 was $5,234,323.

As yet no concern is expressed relative to the future supply of staples. A curtailment in production is guardedly mentioned, but no predictions are being made or speculations advanced. Further developments are awaited.

Financially the trade position is sound, conservative methods and tactics being the rule. Collections have strengthened.

CROSS-ARMS.—Stocks in the East are the lowest on record. In certain sizes none are to be had, and substitutes are being considered.

PORCELAIN INSULATORS.—On low-tension insulators, from 5000 volts to 6600 volts, deliveries are better. On high-tension insulators, from 32,000 volts to 33,000 volts, shipments are running behind. Prices are unchanged.

POLES.—The government is taking over chestnut-pole stocks. Cedar is commanding a better price. For poles on stump an advance of from 5 to 10 per cent was made during the past six weeks.

HOUSEHOLD SPECIALTIES.—In heating appliances, especially tableware, the supply is fair. Shipments are coming through subject to embargoes, with deliveries back two months on several Western lines. There is a possibility of the price of washing machines being revised on account of the recent advance of 10 per cent on galvanized material.

COLLECTIONS AND CREDITS.—Generally collections have improved, and in many instances they are prompt.

POLE MATERIAL.—With the government's extraordinary steel requirements the supply and price of pole hardware is sure to be affected, to express the views of one large distributer. The lack of necessary priority orders is interfering with shipments.

SCHEDULE MATERIAL.—A leading manufacturer on Saturday last announced a lowering of jobbers' discount from 40 to 35 per cent on his entire line.

RUBBER SPECIALTIES.—Producers of rubber electrical specialties have made no announcement as yet since the

government took control of crude-rubber prices, fixing them at from 62 cents to 68 cents a lb.

CONDUIT.—No improvement is reported concerning conduit. The supply continues far from satisfactory, orders of importance being filled on the allotment basis. A couple of cars came in this week because of the temporary lifting of embargoes.

CHICAGO

Electrical contracting activities continue to show a satisfactory increase over the previous week. During the week ended May 8 there were issued 752 electrical permits, aggregating 10,667 incandescent lamps and 1621 hp. Compared with the previous week's figures this shows an increase of 14 per cent in the number of jobs—44 per cent in light capacity contracted for and 23 per cent in power capacity. During the same week a year ago there were issued 836 permits, showing a decrease for this year of only 10 per cent. Building operations have fallen off again. For the week ended May 8 there were issued seventy-three building permits, involving construction work to the amount of $752,900. This is considerably less than the business done the previous week. Comparisons with the previous week's figures show a decrease of 31 per cent in the number of jobs and 16 per cent in the volume of business. For the same period last year there were issued 122 permits, involving $1,405,200, showing a decrease for this year of 40 per cent and 46 per cent respectively.

RECTIFIERS.—There is quite a demand for small rectifiers for charging batteries at present. One local company finds it difficult to fill its orders, not because of lack of material but from shortage of labor.

LAMPS.—The demand for portable lamps, especially of the reedware type, is very good at present, and deliveries are fair.

CONTROLLING DEVICES.—Several manufacturers in this territory are behind in their orders, owing to the filling of government work. They state that they could fill these orders in better shape if it were not for the difficulty in getting labor for their plants.

INSTRUMENTS.—A large instrument maker in this locality reports large orders for instruments with deliveries fair. The labor situation in this work is bad.

CABLE.—The Kansas City Light & Power Company has just purchased a large order of underground cable.

LARGE TURBINES.—An Iona company is soon to place an order for a 20,000-kw. unit.

FANS.—Electric fans are beginning to move in the states of Oklahoma, Arkansas and Missouri. A short and severe hot spell caused all dealers through this territory to put in fan windows.

MOTORS.—Fluor mills are reported to be heavy purchasers of motors at this season.

INCANDESCENT LAMPS.—Stocks are reported to be getting in somewhat better shape in this territory.

BOSTON

The electrical trade in New England now reflects little but war conditions, and every week it seems that ordinary industrial activities grow less important. Business is running at a very high tide, and the extent to which government requirements influence commerce is beyond any previous experience. Despite the heavy calls upon the jobbers and manufacturers entailed by war production plants, stocks are still in pretty fair shape, though railroad congestion hampers refilling in many lines. Collections rule somewhat better than during the late winter, but in order to maintain them satisfactorily the credit departments are obliged to work harder than normally is the case.

Prices are firm this week, with little prospect of softening for the present. Deliveries do not show the desired improvement, although previous shortages are being made up in lamps. The coal situation is very disquieting, and conservation is being urged against the apprehended repetition of last winter's famine conditions. Labor is restive in the electric railway field and central-station linemen show some dissatisfaction with wages and working conditions. The outlook is excellent for legislation looking toward the financial betterment of electric railways and their re-entrance into the electrical supply market on a broad scale.

INDUSTRIAL ELECTRIC TRUCKS.—The demand for war service plant applications is remarkably active, and the difficulties of making prompt deliveries are the chief obstacle to a record-breaking business. Prices remain fairly steady.

MOTORS.—A recent increased demand for motors of ½-hp. and 1-hp. rating is noted, especially for pumping service on large private estates. The shortage of steel for tanks hampers this business somewhat. Motor stocks, especially in smaller sizes, are temporarily lower and the larger sizes are still obtainable only upon relatively long shipments. The opinion is heard that present prices will stand for some time.

FARM LIGHTING SETS.—These are in good demand, with improved road conditions and liberal advertising. The practice of selling some of the best outfits with the batteries initially charged and the wiring ready for immediate service with minor adjustments is proving a help in increasing sales.

STORAGE BATTERIES.—Government demands are so great that the ordinary user is having some difficulty in securing this class of equipment promptly. Stocks are getting low, and plenty of batteries already sold are now on the railroads en route to distributing points.

AUTOMOBILE ACCESSORIES.—The demand is substantial, especially for cars undergoing rebuilding. The trade in charging sets is below normal just now.

FLOODLAMPS.—A fair volume of business is being handled in New England, but manufacturers report a larger amount of business in other parts of the country.

REFLECTORS.—Business is quiet in street-lighting equipment, but very active in products suited to cantonment, navy yard and shipyard service. No recent or prospective price changes are in evidence.

MOTOR CONTROLLERS.—Equipments to fit the requirements of small-motor duty are in demand, especially in shoe factory and pumping service. Stocks are in reasonably good condition, and shipments and deliveries are understood to be well ahead of the game in comparison with motors.

FANS.—Jobbers and dealers are ready for the advance of General Humidity. It is known that some buyers have shaded their 1918 orders as compared with last year. In some quarters a disposition is noted to gamble a bit on a cooler summer.

ATLANTA

There is very little change in general conditions to record for this week. Official announcement has been made that Atlanta and New Orleans have been selected as distributing centers for the Quartermaster's Department. This will call for the erection of new warehouses at New Orleans and extensions to the present Southeastern warehouse facilities in Atlanta.

Coastal cities report a great influx of skilled labor for shipbuilding work. Although extensive housing plans are contemplated, and more or less work has already been done along this line, facilities are far from being adequate. It is expected that construction of this type will expand the present market for staple lines, which, manufacturers and jobbers state, shows exceptional possibilities for 1918. The Foundation Company of New York will invest $1,250,000 at New Orleans for the establishment of a plant to construct a new unsinkable type of steel steamship.

LAMP CORDS.—Stocks are in good shape and ample to take care of the present requirements. Buying continues steady. Prices remain firm.

PANELBOARDS.—There is considerable activity here. Deliveries are being made in two weeks on the panelboards and in ten days on the cabinets.

CONDUIT.—Large orders are being placed, but shipments are very discouraging. The long-expected government requirement for steel has tended to stiffen prices on lots sold from local stocks. While it is conceded that conduit is going to be very scarce during the next few months, no material increase in price is anticipated locally.

SECOND-HAND APPARATUS.—Better promise of shipment on standard motors and transformers has had some effect on the market. Some pieces are not moving so rapidly as they did several months ago. There is a good demand, however, for small direct-current motors, generators, rheostats and miscellaneous material.

WIRING DEVICES.—The volume of business continues large. Prices have advanced this week. Shipments are coming in fairly well.

BOXES AND FITTINGS.—Prices are firm and shipments good. This line has been quite active during the first quarter, and one manufacturer states that sales are well over the same period last year. Jobbers have ample stocks.

ELECTRIC HOISTS.—Shipyards and government warehouses have opened up an extensive field for these, and substantial sales are reported. Although a large quantity of this equipment is being purchased in the East, Southeastern representatives are handling numerous inquiries. The government and industries securing preferential shipments can get the small outfits in two or three weeks. The delivery promise on monorail apparatus, however, has been advanced to eight to twelve months.

SEATTLE

General business continues on the high levels established months ago, with noticeable increases in sales along several lines, including power apparatus for shipyards, which will shortly be in complete operation. A feature of the week's business was a large order placed by a Seattle manufacturing concern for measuring instruments, ammeters, voltmeters, etc. The order is one of the largest ever placed in the Northwest. A pole order of considerable magnitude for electric transmission-line construction was also placed. The contract is for new work, which is gratifying, as other orders placed since the first of the year have been for maintenance only. Trying labor conditions are affecting the electrical trade seriously, and measures of relief afforded are exceedingly small. Conduit shipments have loosened up considerably and power apparatus, including motors, is coming through better.

The feature of the week's industrial activity was the taking over of the shipyard of the Seattle Construction & Dry Dock Company by the United States Shipping Board, which in turn leased the plant to the Skinner & Eddy Corporation for an indefinite period. Subsequent to the transaction the Shipping Board awarded a contract to Skinner & Eddy for additional steel ships, to cost $100,000,000. This order smashes all Pacific Coast records, bringing the grand total of shipbuilding contracts to approximately $250,000,000.

Several industrial plants of considerable size and importance allied to shipbuilding are making arrangements to begin early operations in the Puget Sound district. Work on a two-hundred-thousand-dollar factory for manufacturing machinery for steamships was started in Aberdeen. Orders for considerable electrical equipment for this particular plant were placed during the week. Another large wooden shipbuilding plant is projected in Everett. A four-story concrete hotel one block long and 260 ft. deep, for navy yard workers, is announced for Bremerton, and twelve apartment houses, containing sixteen apartments, for Vancouver, Wash. Approximately $170,000 will be spent at Camp Lewis in constructing additional barracks for 6000 more troops. Base hospital improvements costing $100,000 are also planned.

The market for building materials is increasing steadily, now that the government has authorized wood construction for industrial housing. Further increases in demand will result in orders for 50,000,000 ft. of Douglas fir. The production of spruce for aircraft purposes will be tripled.

The domestic appliances movement continues gratifying. Washing and sewing machines, perhaps, are the best sellers, though vacuum cleaners, flatirons and smaller household utensils are moving briskly. The volume of sales, according to a majority of the jobbers, is far ahead of the same time last year. Dealers report that benefits are still resulting from the pre-Christmas sales campaign. Central stations in this territory are energetically pushing sales with pleasing results. Fixture sales are considerably heavier than anticipated or reported heretofore. This is due to an increase in residence building, apartments and summer homes. Prices show but slight changes and stocks are ample and varied. Jobbers are carrying light stocks of fans, as are the dealers. The season here is short.

SAN FRANCISCO

Reports for the past week show that the dealers' counter business has been poor and that the contracting business has been fair. The members of the recent N. E. L. A. conference at Del Monte returned to their tasks greatly heartened and stimulated. The value of building construction under way in the three cities of San Francisco, Los Angeles and Oakland respectively, for the month of April, was $910,000, $776,000 and $593,000, government work being censored and not included. Deliveries are much better, it being possible to procure large sizes of conduit, large sizes of rubber-covered wire and other staples.

Oriental shippers are hampered by a lack of available shipping space, and it is reported that a big Honolulu warehouse and dock deal has been held up indefinitely on account of this lack of space for material. The United States government reports considerable work to be done to the Fort Mason quartermaster's depot and the Benicia arsenal. New packing plants are being erected at Livingston, Palo Alto and Wheatland. The Union Oil Company is constructing new tanks, office buildings and housing at San Jacinto. The shipbuilding yards of Moore & Scott and the Bethlehem Steel Works have arranged to construct new machine shops and certain office buildings. Word has been received from Washington, D. C., that the first place to receive government aid in the housing of shipbuilding yards will be Mare Island, the government navy yard, where work is to be done under the direction of the Navy Department.

CREDITS AND COLLECTIONS.—Credits and collections are reported fair, with a tendency on the part of credit men to limit outstanding accounts but to assist dealers by the extension of longer terms when the dealers have sold the more expensive devices on time payments.

FIXTURES.—Sales are good but considerably hampered by a strike in one of the large Eastern factories. There is very little call for fixtures that are manufactured along the Coast in various shops, because of lack of building demanding their use. Sales are being confined to glassware with a few brass fittings or rods for supports.

STORAGE BATTERIES.—Manufacturers report a call that is greatly increased over last year, this being due to the greater number of cars used and the heavy service demands that are being made on them.

SEWING MACHINES.—The demand for electrically driven machines and for separate motors continues practically unabated, and will without doubt be increased by the present Red Cross drive.

MOTORS.—The call this year has exceeded all expectations, even after allowing for increased sales for pumping plants due to the lack of rainfall. Strangely enough, this call is for larger sizes, ranging from 15 hp. to 30 hp., showing that large estates, which formerly depended upon natural methods of irrigation or regular systems, have been forced to call for electrical aid.

ELECTRICAL PUMPS.—Recently there has appeared a demand for a small electrical pump driven by 1/6-hp. to ½-hp. motors, and used to average the pressure in large apartment houses or residences.

MOVING PICTURE DEVICES.—A new adapting device is being shown by dealers, operators and theaters, which is designed to do away with the old carbon arc and its requirement of direct current. This adapter utilizes the 600-watt, 30-volt Mazda C lamps.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266 00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 57.25
	No. 12 Solid
Less than coil	List to 15%
Coil to 1000 ft	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List to 120.00
Coil to 1000 ft	$97.75 to $120.66
	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to $126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft	10% to 20%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10% to + 10%
1/5 to std. pkg	8% to 20%
Std. pkg	25% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	12% to + 20%
1/5 to std. pkg	List to 20%
Std. pkg	30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.285	.295

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175-.3195	.3275-.3295
Barrel lots	.2875-.2895	.2975-.2995

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21 00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	List to $82.50	$67.50 to $69.75
3/8-in. d. stp.	$75.00 to 84.00	69.00 to 72.00
1/2-in. s. stp.	List to 110.00	List to 93.00
1/2-in. d. stp.	90.00 to 93.00	92.00 to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	List	$63.75
3/8-in. double strip	78.25-78.75	71.25-71.75
1/2-in. single strip	List	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$38.50-$55.00	$24.45-$26.00	$21.50-$24.00
1/4-in.—	$42.00-$60.00	$27.00-$28.20	$23.50-$26.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$36.67-$55.00	$25.00	$22.50
1/4-in.—	$40.00-$60.00	27.00	25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 12%	7% to 15%
2500 to 5000 lb.	6% to 14%	9% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	5.3% to 6.8%	8.3% to 10.7%
2500–5000 lb.	7.3% to 8.8%	10.3% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

	Std. Pkg.	List
250-Volt		
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	10% to $5.00
1/5 to std. pkg	25% to 4.50
Standard packages, 500. List, each	$0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$6.25
1/5 to std. pkg	5.25
Standard packages, 500. List, each	$0.07.

LAMPS, MAZDA

105 to 125 Volts

	Std. Pkg.	List, Each
Regular, clear:		
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3⅛-in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾-in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅜-in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg. ..... List
Std. pkg 10%

DISCOUNT—CHICAGO

Less than std. pkg. ..... List
Std. pkg 10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$31.00 to $34.90
Coil to 1000 ft	24.98 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00
Coil to 1000 ft	21.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100 ..... $20.00 to $24.00

CHICAGO

Net per 100 ..... $21.75 to $33.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½ 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%-30%	20%
$10.00 to $50.00 list	35%-42%	25%-37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. 10%
1/5 to std. pkg. 20%
Std. pkg. 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. 10%
1/5 to std. pkg. 20%
Std. pkg. 30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $38.00
1/5 to std. pkg.	14.80 to 20.00

Standard package, 2200. List per 1000 $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85 to $29.00	$30.70 to $30.75
1/5 to std. pkg.	11.10 to 15.60	24.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. ..... List to + 10%
1/5 to std. pkg. ..... 8% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg. ..... 24% to 25 cents
1/5 std. pkg. ..... 30% to 23 cents

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.20
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11% to 12%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 20%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 5%
$10 to $25 list	10% to 11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg. ..... List
1/5 to std. pkg. ..... 8% to 15%
Std. pkg ..... 25% to 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg. ..... List to + 20%
1/5 to std. pkg. ..... List to 15%
Std. pkg 30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List to 40%	List to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price ..... $5.00 to $6.00
Discount ..... 25% to 30%

CHICAGO

List price ..... $4.50 to $6.00
Discount ..... 25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0.41¼-$0.43¼
No. 18, full spools	0.36¼- 0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0.60 to $0.65
No. 18, full spools	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-$18.00	$12.50-$14.00	$9.85-$12.25
12	23.25- 25.40	19.96- 21.80	15.60- 19.35
10	32.40- 35.20	27.76- 30.20	21.63- 27.00
8	45.63- 49.15	38.61- 42.10	30.18- 38.00
6	72.40- 77.85	61.71- 66.75	48.25- 60.30

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00	$13.00	$11.50
12	25.33-$25.69	22.02-$25.33	18.55-$20.40
10	30.49- 35.04	27.94- 30.03	22.86- 28.23
8	42.54- 48.97	38.92- 41.98	31.90- 39.42
6	61.46- 67.38	56.15- 62.43	50.53- 56.39

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $36.85
25 to 50 lb.	34.40 to 38.85
50 to 100 lb.	30.40 to 36.10

CHICAGO

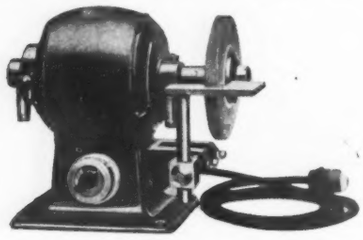
	Per 100 Lb. Net
Less than 25 lb.	$35.42 to $40.00
25 to 50 lb.	34.42 to 39.00
50 to 100 lb.	33.42 to 38.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Buffing and Grinding Motors

Double-spindle and single-spindle motors for grinding and buffing are being marketed by the Bodine Electric Company, 2254 West Ohio Street, Chicago. These machines are made both in alternating-current and direct-current types. The motors all develop 1/6 hp. and carry wheels of 5-in. (12.7 cm.) diameter. Direct-current motors have a speed of 3000 r.p.m. and alternating-current motors a speed of 3400 r.p.m. The grinders are designed to operate from a lamp socket.



COMBINATION OUTFIT OPERATED FROM A LAMP SOCKET

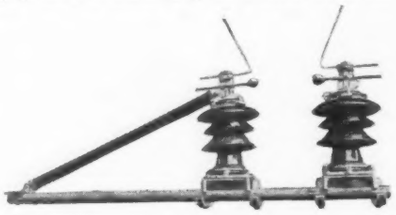
Automatic Motor Starter

Single-phase, polyphase and direct-current motors are automatically accelerated by means of the Johns type motor starter being marketed by the Machine Products Company, 2018 Locust Street, St. Louis, Mo. This device, according to the claims made by the manufacturer, attaches to the end of the motor bearing and effects a saving in wall and floor space over other types of starting equipment. It consists of a plate mounted upon the motor shaft and revolving within the housing. Upon this plate are carried a set of slip rings, a set of laminated contacts, a centrifugally operated mechanism and a ventilated-type resistance. The resistance element is always in series with the motor circuit, the current being carried to the starter through the medium of the brushes and slip rings. Upon closing the motor switch the plate revolves with the motor armature and the weights are thrown outward by centrifugal force. The distance the weights are moved outward depends directly on the speed of the motor. These weights actuate the contact arm and thereby cut out resistance from the motor circuit as the armature attains full speed. A device is provided which prevents the return of the contact arm should the motor speed decrease because of load or decreased voltage, but allows its return when the motor has come to a standstill.

MOTOR STARTER SMALL IN SIZE AND SELF-COOLING

Sphere-Gap Lightning Arrester

A sphere-gap lightning arrester now being manufactured by the Electrical Engineers' Equipment Company of Chicago consists essentially of a sphere gap and a horn gap in series with resistance to ground. This construction has been adopted by the company since it has been shown that a sphere gap will handle high-frequency surges more rapidly than a horn gap. A sphere gap will charge and discharge with great rapidity owing to its great surface and capacity. The horn gap is used to dissipate the arc which results from the surge, as this arc will follow up the horns and extinguish itself. The resistance tube is placed in series with the horn gap and affords an extremely straight path to ground.



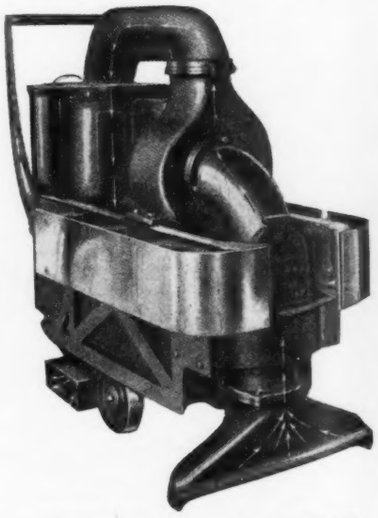
HORN GAP AND SPHERE GAP IN SERIES

Motor-Driven Hammer

A minimum number of parts is used in a motor-driven hammer that is being manufactured by the United Hammer Company, Oliver Building, Boston, Mass. These "Fairbanks" power hammers are operated by an adjustable crank allowing the operator to lengthen or shorten the strokes at will. Motion is applied to the hammer head by means of a connecting rod which carries a cross-head connected to the head by means of links. A heavy spiral spring is used to obtain an elastic blow which removes danger of breakage and also prevents undue shock to the machine. With this arrangement a short quick blow is secured which is most effective and desirable in hammer work. The shaft journals are cast integral with the frame. The hammer is driven by a motor mounted on the machine and connected to the hammer pulley by means of a belt. The motor is left continually in operation during working hours, the belt slipping around the motor pulley when the hammer is not in operation. To start the hammer, pressure is applied to the foot treadle, which through an idler pulley engages the belt and starts the hammer, and as the pressure is increased the speed of the hammer and the force of the blow are increased accordingly. These machines are made in ram weights from 25 lb. to 300 lb. (11.3 kg. to 136 kg.) and require, respectively, motors from 2 hp. to 7.5 hp.

Motor-Driven Broomless Floor Sweeper

Waste that is liable to fall on the floor in cotton mills can be efficiently swept up and recovered by means of the Firth broomless floor sweeper that is shown in the accompanying illustration. It is equipped with an Edison B-4 storage battery and a 0.10-hp., 12-volt motor directly connected to a special fan which creates a suction that picks up the sweepings and delivers them to a waste receiver. This suction air is passed and screened through the receiver, and the discharging current is regulated to force the lint and waste automatically from the spinning frames and other machinery into opposite



WASTE PICKED UP AND DELIVERED DIRECTLY TO RECEIVER

alleys and spare floors, to be picked up later by the machine. The motor is started and stopped by means of a key switch. The battery will drive the motor under ordinary conditions at normal constant speed for four hours and can be recharged by means of a General Electric Company Tungar rectifier that is furnished with the machine if desired. The apparatus is manufactured by William Firth, 200 Devonshire Street, Boston, Mass.

Automatic Electric Toaster

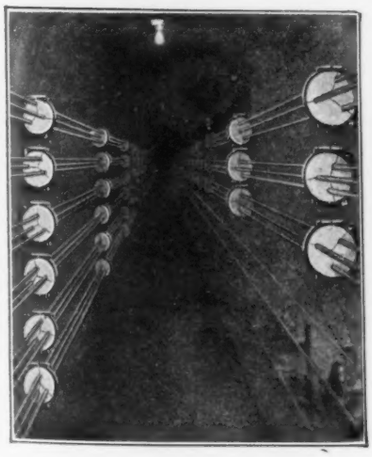
Toast can be automatically turned by an electric toaster being manufactured by the Rutenber Electric Company of Marion, Ind. When the toast is done on one side a touch of the hand on the metal frame automatically turns the toast so that the other side faces the heat. The device also has extra heating surfaces for warming pieces of toast already done.

Locking Socket for Lamp

Maxolite lighting units are now being provided with locking sockets to prevent the removal of incandescent lamps by unauthorized persons. If an attempt is made to remove the lamp, it will rotate without backing out, and the manufacturers claim that this feature is superior to a device which locks the lamp rigidly in place, because any one trying to remove a rigidly locked lamp by force would be likely to break the bulb. This device is being marketed by the Central Electric Company of Chicago.

Three-Phase Wiring Supports

A device that permits an equilateral triangular arrangement of low-tension high-capacity conductors is being manufactured by the Delta-Star Electric Company, 2433 Fulton Street, Chicago.



NEAT AND COMPACT ARRANGEMENT OF THREE-PHASE CONDUCTORS

The manufacturers claim that this support gives a balanced circuit and reduces impedance to a minimum. It makes a compact and neat wiring arrangement for several distribution systems and allows a good space factor for the conductors. The support is especially desirable in mills, mines, railroad shops and on consumer premises.

Speed-Reduction Gears That Require Small Space

The description of the mechanical drive for steam-plant auxiliaries and electrically driven units manufactured by the Poole Engineering & Machine Company of Baltimore, Md., that appeared in the May 11 issue of the ELECTRICAL WORLD was misleading. The planet gears are not held stationary but rotate on their own axes and also revolve about the center of the pinion shaft as a center. The internal gear is held stationary and does not rotate as stated in the article.

Double Electric Range

A double electric range that has two ovens and four or six heating units has been placed upon the market by the Simplex Electric Heating Company, Cambridge, Mass. Each unit has a separate switch and is fused in a cut-out box placed at the end of the range. A small signal lamp indicates whether the current in each unit is turned on or off. The ovens have double walls filled with heat-insulating material. Each oven has a top and bottom heater. They are wired for a three-wire, 120-220-volt service and are furnished either with or without a canopy.

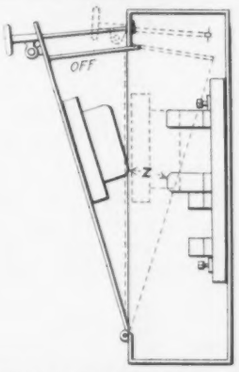
RANGE MARKETED EITHER WITH OR WITHOUT A CANOPY

Motor-Driven Air Station

An isolated prepayment air station for supplying air to automobiles is being marketed by the Electric Appliance Company, 701 West Jackson Boulevard, Chicago. Air is furnished by a Brunner air compressor operated by an Emerson motor, both of which are contained in the pedestal base of the station. The station is equipped with 32 ft. (9.7 m.) of 0.3 in. (0.8 cm.) six-ply hose which is wound on a drum placed inside the base. This holder is released by the deposit of a coin which at the same time starts the compressor. The compressor continues in operation until the holder is released and drawn back into the station.

Safety Switches

Externally operated inclosed switches are being manufactured by the Meyers Electric Safety Switch Company, 1236 Mission Street, San Francisco, Cal. The switches are being made in two types, namely, type A and type B. Type A is a fused knife switch inclosed in a sheet-metal box. The knife blades are attached to the deeply flanged door of the box, so that opening the boxes operates the switch. This switch may be located in the open position. It is made in sizes suitable for 30 amp. to 100 amp. Type B is of the same general construction as type A, but is used only for such service as requires a service or entrance switch. It is made in sizes ranging from 30 amp. to 200 amp.



KNIFE BLADES ATTACHED TO FLANGED DOOR INSURE SAFETY

Electric Sign

The Flashtric Sign Works, 210 North Clinton Street, Chicago, Ill., are manufacturing an art-glass electric sign constructed so that the sign sockets are flush with the art glass, permitting the sign lamps to project beyond the art glass. The sign is constructed in such a way that each letter is supported individually and is a separate unit. The entire frame is constructed of ⅛-in. (0.3-cm.) angle iron heavily coated with zinc to make it rust-proof.

Automobile X-Ray Station

For operating between the field hospitals and firing line a complete X-ray equipment mounted upon an automobile and deriving its power from a 2-kw. direct-current generator driven by the gasoline engine has been developed by the Bleadon-Dun Company, 11 South Desplaines Street, Chicago. The transformer and synchronous motor mounted in the cabinet of the cab operate the X-ray machine, which is of the interruptless type. The radiographic table can be tilted 90 per cent and is equipped with one X-ray tube under the table for fluoroscopic work and one tube above for radiographic work.

Combined Wire Holder and Insulator

No tie wires are necessary in the insulator recently brought out by Hubbard & Company, Pittsburgh, Pa., that may be attached to any type of support. The insulator has an arc-over

OPEN-END WALL PLATE PREVENTS ICE FORMING UNDER WIRE HOLDER

voltage of 1900 volts and provides a good safety factor for voltage up to 500 volts. An open-end wall plate is said to prevent ice forming under the plate in winter and forcing the holder from the wall.

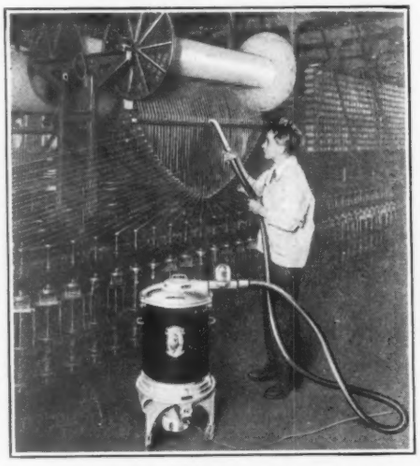
Humidity Controlled by Electric Regulator

In order to regulate and maintain constant humidity of the box drying room, a Western manufacturer has installed automatic electrically controlled heaters. The humidity often varies in this plant from 40 to 100 per cent in twenty-four hours. In fact, with a change of wind the humidity at times varies 30 per cent in one hour. An instrument was designed in which a small rope of human hair is so connected to the mechanism that the change of linear dimension is multiplied sixteen times by a contact beam, which in turn closes a relay circuit and actuates the potential circuit contactor governing electric heaters. Before being used in the instrument the hair was treated so as to remove any oil present. The requirement was that the humidity in this room be held at 55 per cent, and in order to do this under the most adverse weather conditions it was calculated that a heater capacity of 33 kw. would be required.

The electrical distribution system at the plant is three-phase, 440 volts. When the humidity control apparatus was installed the only transformers conveniently available were 2200 to 110-120 volts. These were used as auto-transformers by making star connections on the lower side and taking taps out of the center. Then by connecting to the center taps on the low side of the respective transformers three-phase current at 125 volts was available. The high side of the transformer was connected delta. With this arrangement under the maximum unbalance imposed on the system, the voltage has been found to vary to an amount not in excess of 3 volts. Three very sensitive hydrostats were located along the center line of the room at the quarter, half and three-quarter points respectively. These hydrostats actuated two electrical contacts, which energized a relay on the control board. The relay in turn energized one of the double-pole magnetic contactors, so that each contact controlled a section of the heaters totaling 2.5 kw. in rating. Twenty-two 1500-watt electric heaters were used, these being specially designed for three-phase, 125-volt operation.

Vacuum Cleaner for Factories

Dust and lint can be efficiently removed from machines in textile mills and similar plants by a vacuum cleaner that is now being marketed by the Kent Vacuum Cleaning Company of Rome, N. Y., and is known as the "Vacuna Jumbo." The cleaner works on the same principle as the one described in the March 23 issue of the ELECTRICAL WORLD, the only difference being that it is of a larger size. It has but one moving unit—the single motor shaft on



REMOVING LINT AND DUST FROM TEXTILE MACHINES

which are mounted two metal turbines for producing the vacuum. The ends of these shafts are housed in ball bearings contained in grease chambers.

The motor used is of the universal type and is made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Besides removing dust and lint from the intricate parts of the mechanism, this machine prevents the particles from escaping into the air, from which they will again settle on the machines and works. Fire hazard is also reduced in textile mills because the lint does not collect and become soaked with oil.

Motor-Generator Set for Automobile Batteries

The St. Louis Electrical Works, 4060 Forest Park Boulevard, St. Louis, Mo., are manufacturing a line of motor-generator sets especially designed for charging automobile starting and lighting batteries. The motor-generator sets are designed for simplicity and high efficiency. Three sizes of machines are made. One size will deliver 40 amp. at 60 volts and weighs 520 lb. (236 kg.). A second size will deliver 25 amp. at 40 volts and weighs 274 lb. (124 kg.). The third size will deliver 12 amp. at from 24 volts to 30 volts and weighs 143 lb. (65 kg.). The largest size will charge as many as sixty-four batteries at one time.

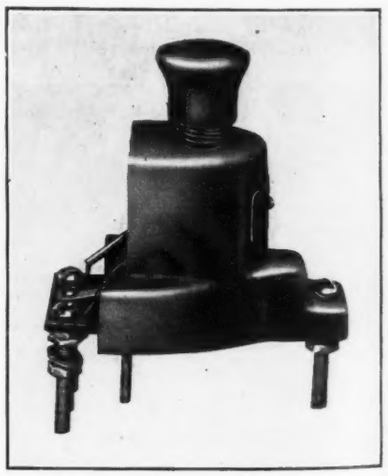
The generator in these sets is of the straight-shunt type. The shunt winding is made of enameled wire. The poles are built of laminations, and the armature is constructed of electrical sheet steel with a comparatively large number of slots. Both the motor and generator are equipped with ball bearings.

Feeder Wire Splicer

A light feeder wire splicer that is easily installed and so designed as to permit removal and reuse is being manufactured by the Ohio Brass Company, Mansfield, Ohio. This device is non-fouling, and can be pulled over cross-arms with foreign wires without catching and thereby causing damage to the wires.

Cut-Out for Farm-Lighting Systems

Farm-lighting systems can be automatically controlled by the reverse current cut-out, as shown in the accompanying illustration. This device will close the circuit when the generator voltage is about 40 volts, and will automatically open it when the charging current is reduced to zero and the battery voltage is higher than the generator. It is especially adapted for use with a gas-engine-driven dynamo set of 1200 watts or less, and is made in standard sizes for 40 volts and 30 amp. Combining reverse cut-out with the start-stop and ignition switch, protection is obtained against the damage usually caused when switches are closed at the wrong time. The engine is started by pushing a handle of the switch. This device is manufactured by the Ward Leonard Electric Company, Mount Vernon, N. Y.



COMBINED CURRENT CUT-OUT AND START-STOP AND IGNITION SWITCH

Trade Publications

BLOWERS.—The Coppus Engineering & Equipment Company, Worcester, Mass., has issued a bulletin describing its turbo-blowers for undergrate draft.

MOTOR PROTECTION DEVICE.—"The Proper Care of Electric Motors" is the title of a booklet issued by the Motor Protection Company, Pawtucket, R. I.

PIPES.—The A. M. Byers Company, Pittsburgh, Pa., has issued a circular showing a micro-study of Byers wrought-iron pipe and how a cross-section of Byers ⅛-in. pipe appears magnified sixty diameters.

ELECTRIC LIGHTING SYSTEM.—"Electrically Lighted Country Places" is the title of a circular issued by the Brackett, Shaw & Lunt Company, Somersworth, N. H., describing its "Quality" electric lighting system.

WATER SYSTEMS.—The Brackett, Shaw & Lunt Company, Somersworth, N. H., has issued a circular describing the Reliance hydro-pneumatic water system. This system gives water under pressure for country places and has all the conveniences of city water systems.

MOTOR GENERATORS.—The St. Louis Electrical Works, 4060 Forest Park Boulevard, St. Louis, Mo., has issued a booklet describing and illustrating its motor-generators and charging panels, which are designed especially for charging automobile starting and lighting batteries.

ELECTRCAL LABORATORY APPARATUS.—The General Electric Company has issued bulletin No. 40,406, describing a complete line of small electrical laboratory apparatus for educational institutions. These units have been designed and built to incorporate the general characteristic features of large commercial electrical types, but of dimensions, capacities and interchangeability of parts adapted to experimental and instruction purposes. This bulletin is well illustrated and gives a list of nearly 120 institutions where G-E electrical laboratory apparatus have been installed.

RECEPTACLES AND APPLIANCES.—"Diamond H" switches are illustrated and described in a bulletin being distributed by the Hart Manufacturing Company of Hartford, Conn. The devices included in the booklet are push-button switches, rotary push and rotary surface switches and flush receptacles. Remote-control and automatic door switches are also described in full, with details of construction. The "Diamond H" relay-control system, with double-throw combinations, is illustrated by wiring diagrams. No-voltage-release remote-control switches are discussed and wiring diagrams printed.

LIGHT FOR THE CLOTHING INDUSTRY.—The Edison Lamp Works of the General Electric Company have prepared bulletin No. 43,410, containing the latest information as to the correct methods of lighting industrial plants, especially those devoted to the manufacture of clothing for our fighting forces at home and abroad. The bulletin is well illustrated, showing various lighting schemes most suitable for industrial purposes, and the facts are brought out that to conserve the employees' health, to save coal, to increase the output and to keep the workers contented, it is necessary that a shop be well illuminated according to modern methods.

INSULATING MATERIALS.—One of the most comprehensive catalogs issued on this line is that recently distributed by the Mitchell-Rand Manufacturing Company of New York City, entitled "Everything in Insulation." Not only are the many forms of insulating illustrated, but a detailed description is given of the treatment of the raw material through the various process stages until the finished article is reached. Various tables of values to those interested in the meaning, purpose and application of these specialties are furnished, with carefully prepared chapters by an expert on insulating paints and varnishes, waxes and compounds. The cross-index gives additional value to this very complete publication, copies of which may be obtained free on application to the company.

ELECTRIC INDUSTRIAL STOVES.—A new folder of publication No. 233 has recently been issued by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., which illustrates and describes the C-H electrical industrial stoves for laboratories, printing and publishing plants, celluloid, hat and shoe factories, test rooms and industrial service in general. The stoves are made in two types, one with a rectangular heating surface and the other with a disk or circular surface. The heating units are electrically welded to the working surface. The folder describes other details of construction and gives size, wattage and other data.

Trade Notes

G. V. P. LANSING, 508 West 112th Street, New York City, has been made local representative for the F. S. Payne Company, manufacturer of electric elevators, Cambridge, Mass.

THE M. B. AUSTIN COMPANY, manufacturer of the Austin line of conduit fittings and wiring devices, Chicago, is the new name of what was formerly M. B. Austin & Company.

THE INTERNATIONAL INSULATING CORPORATION of New York City has taken over the Dickinson Manufacturing Company of Springfield, Mass. The new company's facilities will be materially enlarged.

McMEEN & MILLER, engineers, Chicago, are being dissolved on account of war conditions. It is probable that Kempster B. Miller will continue in practice at the old address. Announcement will be made as soon as plans are more definitely formulated.

THE MAIN ELECTRIC MANUFACTURING COMPANY of Pittsburgh, Pa., is exporting lighting plants of several sizes to South America and India. The United States government has also recently ordered lighting plants in the larger unit size from the company.

THE EASTERN TUBE & TOOL COMPANY is now the name of what was formerly the Eastern Flexible Conduit Company. The company has added to its former line the manufacture of drill chucks and small tools. The factory is at 41 Gardiner Avenue, and the general office address is 594 Johnson Avenue, Brooklyn, N. Y.

THE CHAMBER OF COMMERCE OF PARIS, France, announces that the Paris Sample Fair, which was to be held from May 15 to 30, has been postponed to the first weeks of September. The chamber has received a certain number of pamphlets giving details relative to this national fair, and members may obtain copies of these at its offices.

THE CRANE PACKING COMPANY of New York City has removed to larger quarters in the Park Row Building. Julian N. Walton has been appointed manager. A. W. Payne, connected for some time as manager of the New York district, has been made sales manager of the United States and Canada with headquarters at the home office in Chicago.

F. E. LAUDERBACH has been appointed district manager for the Bussmann Manufacturing Company, St. Louis, Mo. He will have charge of the company's sales in Ohio, western Pennsylvania, West Virginia, Virginia, North and South Carolina, Georgia, Florida, Tennessee, Kentucky and Indiana. Mr. Lauderbach was formerly supervising engineer and manager of the St. Louis office of the National X-Ray Reflector Company.

THE ENAMELING & STAMPING CORPORATION OF NEW YORK, Long Island City, N. Y., has purchased the plant of the Fickling Enameling Corporation of that place. W. I. Fickling is president of the new company, and H. F. Holbrook, formerly president of the Holbrook company, secretary and treasurer. Its capacity has been greatly enlarged, and still further additions are being made to ovens and equipment.

D. C. & WM. B. JACKSON, engineers, Boston and Chicago, on account of two members of the firm having gone into the national service and the third member expecting to do so as soon as practicable, announce that they will close their offices and suspend business for the duration of the war as soon as the work with which they are now occupied can be completed. The firm expects to resume business on the conclusion of the war.

THE DRIVER-HARRIS COMPANY of Harrison, N. J., announces the election of the following officers: Frank L. Driver, president; Arlington Bensel first vice-president; Leon O. Hart, second vice-president; Frank L. Driver, Jr., third vice-president; Percival E. Reeves, treasurer; Stanley M. Tracy, assistant treasurer, and M. C. Harris, secretary. Wilbur B. Driver, formerly vice-president, general manager of manufacturing, has retired from active participation in the business. Mr. Driver says that probably he will engage in a similar line.

New Incorporations

THE GRAZIER ELECTRICAL PRODUCTS COMPANY of Johnstown, Pa., has been chartered with a capital stock of $40,000 by J. S. Grazier and others.

THE LILLICK ELECTRICAL COMPANY of Iowa City, Iowa, has been incorporated with a capital stock of $5,000 by C. H. Myers, C. W. Lillick and others.

SPERRY & BITTNER of Pittsburgh, Pa., has been granted a charter with a capital stock of $10,000 to deal in electrical machinery. William A. Bittner is treasurer.

THE RAILWAY & POWER EQUIPMENT COMPANY of New York, N. Y., has been organized with a capital stock of $100,000. The directors are: A. G. Logan and Ernest Stuart of Brooklyn.

THE KAY BEE MANUFACTURING COMPANY of Los Angeles, Cal., has been chartered with a capital stock of $25,000 by Kirk White, B. A. Weyl and Charles E. Fleming. The company proposes to manufacture lighting fixtures, etc.

THE GUIDE & SIGNAL LIGHT COMPANY of Shelbyville, Ind., has been organized to manufacture an oscillating device for fans and searchlights, invented by L. Greenberg of Indianapolis. C. S. Camplin of Detroit, Mich., will be manager.

THE ELECTRICAL SERVICE & SUPPLY COMPANY of Sharon, Pa., has been incorporated with a capital stock of $5,000. The incorporators are: Charles R. Nelson of Sharpsville; George R. Davis, Frank L. Kreider, Karl Kohn and C. L. Kemery of Sharon.

THE B. F. S. MANUFACTURING COMPANY of Worcester, Mass., has been incorporated by B. F. Stenman, Carl W. Fors, Charles E. Mattson and Henry Lindberg. The company proposes to manufacture electric valve grinders and special machinery.

THE LIBERT LIGHTING SUPPLY COMPANY of New York, N. Y., has been incorporated by Henry Hoffman, Maurice P. Hartman of New York City and Aaron Weiss of Brooklyn. The company is capitalized at $5,000 and proposes to deal in electric and gas supplies, etc.

THE BEACH ELECTRIC COMPANY of San Francisco, Cal., has been incorporated by Harry Beach, Theodore O. Pass, A. P. Burr, all of San Francisco, Cal. The company is capitalized at $10,000 and proposes to do a general electrical and mechanical electrical engineering business.

A. A. SHEA, INC., of Springfield, Mass., has been incorporated with a capital stock of $12,000 to manufacture and deal in electrical machinery and equipment. The directors are: Augustus Shea, 94 Pearl Street, Springfield, president and treasurer; L. R. Schechterle and E. J. Roberts.

THE VENTILATOR FAN COMPANY of New York, N. Y., has been incorporated with a capital stock of $5,000 to do a general electrical and mechanical engineering business. The incorporators are: J. Gerber, 10 Prospect Park S. W. Brooklyn; M. A. Connelly and Paul G. Burroughs of Brooklyn.

THE WILSON ELECTRIC COMPANY of Jacksonville, Fla., has been incorporated with a capital stock of $5,000 to manufacture and deal in and repair electrical supplies and machinery, etc. The officers are: Jesse L. Wilson, president; M. W. Wilson, vice-president, and W. J. Wilson, secretary and treasurer.

THE INTERNATIONAL INSULATING CORPORATION of New York, N. Y., has been incorporated with a capital stock of $60,000 by O. and A. Heineman, 25 West Forty-fifth Street, and J. Schechter, 10 Wall Street, New York City. The company proposes to deal in insulating materials, phonographs and talking-machine records.

CONNETT, BURTON & COMPANY of New York, N. Y., has been incorporated by W. S. Lare, H. Rogers and H. McAndrew, 30 Broad Street, New York City. The company is capitalized at $300,000 and proposes to act as agents contractors and engineers, in connection with electrical work, ice manufacturing, textile plants, etc.

THE ABELES-LALLEY LIGHT CORPORATION of New York N. Y., has been incorporated by S. Andrews, 12 Locust Street, Flushing; L. Fischel, 242 West Seventy-second Street, and H. H. Seabrook, 510 Audubon Avenue, New York City. The company is capitalized at $30,000 and proposes to manufacture individual electric-light and power plants.

New England States

BANGOR, ME.—A 500-kw. generator is being installed in the Veazie power plant of the Bangor Railway & Electric Company, at a cost of about $55,000. The company is now erecting transmission lines to Passadumkeag to supply electricity to the mill of the American Realty Company. This 33,000-volt line runs from Ellsworth to Brewer, Milford, through Costigan, Passadumkeag, Enfield and Lincoln. A power installation is now being placed in the shipbuilding plant of the Bangor-Brewer Shipbuilding Company at South Brewer.

BIDDEFORD, ME.—The Public Utilities Commission has granted the petitions of the York County Power Company of Biddeford for approval of contracts with the Ogunquit Village Corporation for lighting the streets of the village for a period of five years from June 1, 1918. Also for municipal lighting in the town of Wells for five years from July 15, 1917.

DERRY, N. H.—The Derry Electric Light Company is contemplating extending its electric transmission line from East Derry along the Hampstead Road to furnish electricity to residents in that section.

MANCHESTER, N. H.—Bids, it is reported, have been taken by the Manchester Traction, Light & Power Company for the construction of an addition, 25 ft. by 45 ft., to its local power house. F. W. Gray, Elm Street, Manchester, is architect.

PORTSMOUTH, N. H.—Plans are being prepared for 200 houses which are soon to be erected by the Emergency Fleet Corporation, to be located at Portland, for the employees of the Atlantic Corporation builders.

ENOSBURG FALLS, VT.—The Water and Light Commissioners have been instructed to purchase a suitable hoist for operating the four headgates at the municipal electric-light plant, and also to purchase a Tirrill voltage regulator, the cost not to exceed $400, the old dynamo to be exchanged in part payment of same.

CLINTON, MASS. — Work has been started on the construction of a power house and a 100-ft. smokestack at the Rubiax Mills. Two new boilers will be installed.

NORTH BILLERICA, MASS.—The Board of Selectmen has approved the application of the Lowell Electric Light Corporation for extensions of its electric lines in Pine, Gorham and Chadwick Streets.

STERLING, MASS.—At a special town meeting held recently it was decided to appropriate $7,000 for the purpose of extending the electric lighting system to supply electricity to residents in Washacum Park.

STOCKBRIDGE, MASS.—The State Board of Electric Light and Gas Commissioners has approved the merger of the Stockbridge Lighting Company, the Lenox Electric Company and the Great Barrington Light Company, to be operated under the name of the Stockbridge Lighting Company.

WORCESTER, MASS.—The New England Power Company is planning to erect a new office building at 36-37 Harvard Building, to replace the one damaged by fire on March 9.

LONSDALE, R. I.—Work is under way on the installation of a new power system in the Lonsdale and Ashton mills of the Lonsdale Company. The mills, operated by water and steam power, are now being equipped for electrical operation. Energy for operating the mills will be furnished by the Rhode Island Power Transmission Company, a subsidiary of the Connecticut River Transmission Company of Brattleboro.

BRIDGEPORT, CONN.—Extensions are contemplated to the plant of the Remington Arms-Union Metallic Cartridge Company in Bridgeport, including the erection of an addition, 112 ft. by 256 ft.; one two-story building, 50 ft. by 220 ft.; two one-story buildings, 60 ft. by 120 ft., and several other one-story structures.

NEW HAVEN, CONN.—Work has begun by the United Illuminating Company for laying the cables for the ornamental lighting system in Grand Avenue from Olive Street to Mill River.

Middle Atlantic States

BROOKLYN, N. Y.—Plans have been prepared by the Long Island Railroad Company for the erection of a new engine house, 35 ft. by 100 ft., at Eighth Avenue and Sixth Street, to cost about $15,000.

BROOKLYN, N. Y.—Contract has been awarded by the Brooklyn Gas Company to John H. Deeves & Brother, 103 Park Avenue, New York City, for the construction of an addition, 30 ft. by 40 ft., to its boiler plant.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way.

BROOKLYN, N. Y.—Plans have been prepared by the Bush Terminal Company, 100 Broadway, New York, for the construction of an addition to its local transformer station. Improvements are also contemplated to the present building.

BROOKLYN, N. Y.—Contract has been awarded by the James A. McCafferty & Sons Manufacturing Company, 505 Driggs Avenue, Brooklyn, for the construction of an addition to its plant in Middle Village to W. Southall of Middle Village, to cost about $50,000. The company manufactures dry batteries, etc.

BROOKLYN, N. Y.—Plans are being prepared by Helmle & Corbett, of Brooklyn, architects, for the building to be erected for the Williamsburg Hospital, at the corner of Driggs Avenue and South Ninth Street. The proposed building will be 126 ft. by 150 ft., seven stories high. The cost is estimated at $350,000.

BUFFALO, N. Y.—The Demarest Heating Corporation is considering plans for extensions and improvements to its plant.

BUFFALO, N. Y.—Plans have been prepared for the erection of an addition, 35 ft. by 55 ft., to the engine plant at the works of the Fleischman Malting Company, at 2212 Niagara Street, to cost about $12,000.

BUFFALO, N. Y.—Extensions are contemplated by the Foster Specialties Company, Eighteenth Street, including the erection of a three-story addition, 50 ft. by 250 ft., to its mold shop, a one-story foundry and a six-story general manufacturing building.

NEW YORK, N. Y.—The Interborough Rapid Transit Company is building a new transformer station at 150 East Fifty-seventh Street, to cost about $45,000.

NEW YORK, N. Y.—Bids will be received by the Board of Health, Department of Health, Centre and Walker Streets, New York City, until June 3 for furnishing and installing lighting fixtures, etc., together with all necessary alterations, etc., as follows: (a) In the pavilion for venereal diseases; (b) in the dormitory for female help on the grounds of the Riverside Hospital at North Brother Island, borough of Bronx. Plans may be seen and blank forms, etc., obtained at the office of the purchasing agent of the Department of Health, Centre and Walker Streets, New York City.

NEW YORK, N. Y.—Bids will be received by W. W. Wotherspoon, superintendent of public works, Capitol, Albany, until June 18, under terminal contract No. 105, for installing the electric wiring, lighting, power, battery-charging equipment and auto scales for Pier 6, East River, New York City. Plans and specifications, proposal blanks, etc., may be obtained at the office of the superintendent of public works, Albany; office of the assistant superintendent of public works for the Middle Division of Syracuse, office of the assistant superintendent of public works for the Western Division at Rochester, and at the canal office, Spaulding's Exchange, Buffalo.

NIAGARA FALLS, N. Y.—Plans are being considered by the City Council for the installation of new electrically driven pumping machinery in the municipal water-works pumping station on Buffalo Avenue.

NIAGARA FALLS, N. Y.—Preliminary plans have been prepared by the Niagara Falls Gas & Electric Light Company for the construction of a new gas plant in Niagara Falls. Willis Adams, Loan Association Building, is engineer.

SCHENECTADY, N. Y.—Plans are being prepared for the erection of an addition, about 120 ft. by 175 ft., to the boiler house at the local plant of the American Locomotive Company.

WATERTOWN, N. Y.—The Brown bill reorganizing the Water Board of the city of Watertown under the name of the Water, Light and Power Board, giving it authority to generate electricity on power sites already owned by the city, to light the streets of the municipality, and to sell excess power within and without the city, has been signed by Governor Whitman.

WELLSVILLE, N. Y.—Notice has been filed by the Kerr Turbine Company of an increase in capital stock from $500,000 to $2,000,000, to provide for expansion. The company manufactures turbine engines.

DOVER, N. J.—The New Jersey Power & Light Company of Dover has secured a contract to furnish electricity to operate the plant of the Thomas Moore Trench Machine Company, recently established at Rockaway.

GLOUCESTER CITY, N. J.—Work has begun on the construction of the proposed new power plant to be located on the site of the old Gloucester baseball grounds by the Pusey & Jones Company. The new plant will supply energy to the plants of the Pennsylvania and New Jersey Shipbuilding companies.

JERSEY CITY, N. J.—Plans have been prepared by the Central Railroad of New Jersey, Communipaw Avenue, for the erection of an addition to its local power house, to cost about $50,000.

JERSEY CITY, N. J.—The Board of Freeholders has approved an appropriation of $25,000 to provide for initial expenditures in connection with the construction of the proposed new central power plant for Hudson County.

NEWARK, N. J.—Bids will be received by the Board of Education, Newark, until June 3, for electric work, lighting fixtures and heating system for the new addition to the Hawkins Street School. R. D. Argue is secretary.

NEWARK, N. J.—Plans are being considered by the Heller & Merz Company, Hamburg Place, for the erection of a new power house, 33 ft. by 70 ft., at its plant. R. G. Corry, 30 Cortlandt Street, New York City, is architect.

NEWTON, N. J.—Plans are being considered for the erection of an addition about 50 ft. by 50 ft. to the power plant of the Sussex Print Works, to cost about $10,000. Andrew Kidd, Jr., 95 Liberty Street, New York City, is architect and engineer.

VERONA, N. J.—Bids will be received by the Board of Education of Verona until June 4, for the electrical work in connection with the new school building to be erected on Laning Avenue, near Elmwood Road. Bids will also be received for the installation of a heating system. John Culvert is district clerk.

WOODBRIDGE, N. J.—Bids will be received by the Township Committee of Woodbridge until June 3 for electrical work in connection with the new municipal building to be erected, and the installation of a new heating system. Andrew Keyes is township clerk.

BEAVER FALLS, PA.—Work has begun on the installation of the proposed new street-lighting system here. The contract calls for the erection of 100-cp. gas-filled electric lamps mounted on steel poles. Owing to the high price of steel and the government demand for it the Borough Council has granted the Duquesne Light Company permission to use wooden poles temporarily.

LEBANON, PA.—Contracts have been awarded by the Lebanon Steel Foundry Company for the erection of an annex, 100 ft. by 200 ft., to its plant. A second two-ton Heroult electric furnace is to be installed with sufficient number of annealing furnaces to handle the product.

NEW CASTLE, PA.—The New Castle Electric Company has filed notice with the Public Service Commission of an issue of $11,000 in bonds, the proceeds to be used for improvements.

NEW CASTLE, PA.—Notice has been filed by the Shenango Valley Electric Company with the Public Service Commission of an issue of $39,000 in bonds, the proceeds to be used for extensions and improvements to its system.

PHILADELPHIA, PA.—The Philadelphia Electric Company is contemplating the erection of an addition, about 20 ft. by 45 ft., to its building at Arch and Mascher Streets.

PHILADELPHIA, PA.—Plans have been prepared for an addition, 30 ft. by 52 ft., five stories and basement, to the plant of James F. Burns, 713 Cherry Street, Philadelphia, manufacturer of electrical supplies and devices.

PHILADELPHIA, PA.—Contract has been awarded by John Bromley & Sons to George W. Stewart & Company, 2123 Germantown Avenue, for extensions and improvements to its boiler plant at Front and Dauphin Streets.

PHILADELPHIA, PA.—Work has begun on the construction of a one-story addition, 280 ft. by 345 ft., at the woodworking plant of George W. Smith & Company, located

on Forty-ninth Street, near Botanic Avenue, to cost about $150,000. The office of the company is at 3907 Powelton Avenue.

PITTSBURGH, PA.—E. R. Crawford, president of the McKeesport Tinplate Company, has announced that work will begin on the erection of a new steam power plant at its local mills, to cost about $1,200,000, as soon as possible. Negotiations are pending with the government for the right to erect a wall 400 ft. long and 15 ft. high along the bank of the Youghiogheny River, at the site, between the Thirteenth and Fifteenth Street bridges, Portview Township.

WILMINGTON, DEL.—Application has been made to the City Council by the Tidewater Power Company for permission to extend its street railway on South Front Street to the city limits and to construct a connecting track on Third Street.

BALTIMORE, MD.—The United Railways & Electric Company has been granted permission to construct its proposed extension to Wagner, in Anne Arundel County, near Baltimore, to serve several industries.

CUMBERLAND, MD.—The City Commission has notified the Edison Electric Illuminating Company of its intention to renew the contract for street-lighting for an additional term of ten years. On July 1, 1917, the city entered into a contract with the company whereby the latter was to light the streets and city buildings for one year ending June 30, 1918. Under the terms of the contract the city has the option of extending the contract for 10 years at the expiration of the year.

HUNTINGTON, W. VA.—Bids will be received by the Board of Commissioners of the city of Huntingdon until June 10 for lighting the streets of the city. Further information may be obtained from the city clerk and the city engineer. K. L. Hamilton is city clerk.

NEWPORT NEWS, VA.—Application has been made to the City Council by J. N. Shanahan of Hampton, representing the Emergency Fleet Corporation, for permission to construct a street-car line on Fiftieth and Fifty-fifth Streets and Virginia Avenue to furnish transporation to the workmen at the shipbuilding town now being established north of the city limits.

North Central States

CINCINNATI, OHIO.—The Mayor has requested the Cincinnati Traction Company to begin work at once on the construction of an extension to its Warsaw Avenue line.

CINCINNATI, OHIO.—Application has been made to the Council Committee of Street Lighting by J. H. Wulfekoetter, representing the residents of Cottage Hill, asking for a better street-lighting service in that suburb. The present system he states is inadequate, and that many of the streets have no lamps.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until May 31 for motor drives for two sluicegates for the Division Avenue pumping station. Blanks and specifications may be obtained on application to the commissioner of water.

CLEVELAND, OHIO.—An agreement has been reached between the Municipal Electric Light Department and the Cleveland Electric Illuminating Company through the National Council of Defense whereby an interchange of electric output will be made. The proposed connection will cost about $90,000 and will include the erection of an overhead line between the East Fifty-third Street station of the municipal system and the power plant of the Cleveland Electric Illumination Company on East Seventy-second Street, to provide interchange of power in case of breakdown of either plant. It will be financed by the National Council of Defense.

GALION, OHIO.—The plant and holdings of the North Electric Company of Galion have been taken over by a new corporation to be known as the North Electric Manufacturing Company. The company is capitalized at $3,000,000 and will carry on the business in this city on a much larger scale.

MASSILLON, OHIO.—Work has begun by the Massillon Electric & Gas Company on the construction of a new switchboard at its plant on South Erie Street, to replace the one destroyed by fire recently. J. F. O'Connor is superintendent.

POMEROY, OHIO.—Work has begun on the construction of the power house for the local lock and dam under the supervision of E. H. Groot, government superintendent of the lock and dam. The building is to be 40 ft. by 19 ft.

TOLEDO, OHIO.—The Liberty Equipment Company, recently incorporated with a capital stock of $100,000, proposes to operate a tractor train service between Detroit, Mich., and Toledo, Ohio, at once. The company will begin with a high-power tractor and 16 trailers. Later on the Liberty Highway Company will operate tractor trains between Toledo and other cities. Frank C. Schmidt and Frank L. Baird are interested in both companies.

YOUNGSTOWN, OHIO.—The Hydraulic Gas & Power Company contemplates increasing its capital stock from $200,000 to $300,000, the proceeds to be used for extensions and improvements to its system.

INDIANA HARBOR, IND.—The Mark Manufacturing Company has awarded the contract for the construction of its proposed new steel plant at Indiana Harbor to the Powers-Thompson Company of Joliet, Ill. The original plans provided for an expenditure of $2,000,000, but it is estimated that the plant complete will cost about $5,000,000.

SHELBYVILLE, IND. — The Guide & Signal Light Company, recently organized, is planning to establish a plant for the manufacture of an oscillating device for fans and searchlights, invented by L. Greenburg, of Indianapolis. C. S. Camplin of Detroit, Mich., will be manager.

CARBONDALE, ILL.—The Illinois Central Railroad Company is planning to erect a 72-stall roundhouse and mechanical plant in Carbondale, to cost about $200,000. Much of the heavy work will be transferred from the Burnside shops to this plant.

CHICAGO, ILL.—Contract has been awarded by the Electric Steel Company, Wood and Thirty-first Streets, to the E. W. Sproul Company, 1120 West Thirty-first Street, for the erection of a one-story extension, 130 ft. by 300 ft., to its foundry.

GALESBURG, ILL.—The installation of the new ornamental lighting system in the business section of the city is nearly completed. The cost of system is estimated at about $30,000.

MOLINE, ILL.—A new 22,500-kw. turbine is being installed at the power house of the Tri-City Railway, Light & Railways Company in Moline.

ROCKFORD, ILL.—A resolution has been adopted by the City Council providing that steps be taken to secure a bond issue of $500,000 for establishing a municipal electric-light plant in Rockford.

MILWAUKEE, WIS. — Contract has been awarded by the Pawling & Harnischfeger Company of Milwaukee for the construction of a machine shop addition, 80 ft. by 175 ft., to its main plant at Thirty-eighth and National Avenues.

MILWAUKEE, WIS.—Plans are being prepared by the Allen-Bradley Company, 495 Clinton Street, for the erection of an addition, 50 ft. by 100 ft., to its shop. The company manufactures rheostats and other electric controlling devices, etc. A. C. Eschweller, Goldsmith Building, is architect.

MILWAUKEE, WIS.—The Universal Machinery Company, 784 Thirtieth Street, Milwaukee, has engaged Frank E. Gay, architect, 86 Michigan Street, to prepare plans for its proposed new foundry and machine shops, to be located at the foot of Sixty-fourth Avenue. The foundry equipment will include one 10-ton crane and a number of smaller cranes and hoists. The cost of the work is estimated at $250,000. E. C. Devlin is president.

CHASKA, MINN.—Bids will be received by the City Council of Chaska until June 3 for one 4-in., two-stage, high-lift centrifugal pump, directly connected to a 20-hp., 60-cycle, 220-volt General Electric squirrel-cage induction motor with hand compensator. The outfit to be designed to deliver 250 gal. per minute against a total head of 145 ft. J. M. Aretz is city clerk.

COLERAINE, MINN.—Bids will be received by the Board of Education of School District No. 2, Itasca County, Coleraine, until June 1 for electric wiring and fixtures for school buildings at Marble and La Prairie. Separate bids to be submitted for fixtures in each building. W. T. Bray, Fidelity Building, Duluth, is architect.

GLEN LAKE, MINN.—Bids will be received by Sund & Dunham, architects, 514 Essex Building, Minneapolis, until May 31 for a built-in refrigerator and refrigerating machinery at the tuberculosis sanatorium for Hennepin County. Rose & Harris of Minneapolis are engineers.

WILLMAR, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until May 28, for the erection of farm buildings, including general contract work, plumbing and electrical work, at the State Asylum at Willmar. Plans are on file at the office of the Board of Control St. Paul, office of the superintendent of the institution, Willmar, and at the Builders' Exchange in St. Paul, Duluth and Minneapolis. C. H. Johnston, 715 Capital Bank Building, St. Paul, is architect.

KANSAS CITY, MO.—Plans have been completed by the City Engineering Department for commercializing Blue River from its mouth to Fifteenth Street. Plans provide for a dam at Tenth Street, but for no lock, the boats and barges to be placed on a low car below the dam and pulled around it to a higher level on track by electric power. The cost of the entire project is estimated at about $1,000,000.

CROSBY, N. D.—The building occupied by the Crosby Light & Power Company and the Crosby Auto Company was recently destroyed by fire. The damage to the electric plant is estimated at $18,000 and to the auto company at $10,000.

PEMBINA, N. D.—Bids will be received by the school board of Pembina at the office of the clerk until June 11 for the construction of grade and high school. Separate bids to be submitted on heating, plumbing, electric wiring, vacuum piping, etc. Copies of plans and specifications may be obtained at the office of W. D. Gillespie, architect, Fargo, upon deposit of $5. Peter Lere is clerk.

SCHUYLER, NEB.—At an election held recently the proposal to issue $40,000 in bonds for improvements to the municipal electric light plant was defeated.

PLAINVILLE, KAN.—The contract for erecting the proposed new electric transmission line from Plainville to Palco and also installing the distributing system in the latter place has been awarded to J. H. Lee. The Plainville Mill & Elevator Company, which is to furnish electricity in Palco, reserves the right to use the line and may install an electric system in Zurich.

QUINTER, KAN.—At an election held recently the proposal to issue $5,000 in bonds for improvements to the municipal electric light plant was carried.

Southern States

GIBSONVILLE, N. C.—Plans are being considered by the Gibsonville Milling Company to erect an electric transmission line from Summers Mill to Gibsonville, a distance of 5½ miles.

ESTILL, S. C.—The Estill Enterprise & Fertilizer Company, recently organized, is contemplating the construction of a fertilizer plant. The proposed plans provide for the installation of a fertilizer mixer, cotton gin, ice factory and electric plant, to be driven by an oil engine. Part of the machinery, it is understood, has been purchased.

ACWORTH, GA.—Plans are being considered for equipping the Acworth Hosiery Mills with electrically operated knitting machines, to cost about $16,000.

KEY WEST, FLA.—The Bell Telephone Company is planning to erect a new telephone exchange to cost about $200,000.

DAYTON, TENN.—The Dayton Light & Power Company is erecting an electric transmission line from Spring City to Dayton with a view of abandoning its steam power plant at Dayton.

NIXON, TENN.—The Nixon Electric Light & Power Company, recently organized, has acquired the plant and holdings of the Nixon Electric Company. The new owners contemplate the installation of a new 17½-kw. alternator. W. L. Hoover is manager.

ROCKWOOD, TENN.—The Public Light & Power Company of Chattanooga is contemplating rebuilding its electric transmission line from Lenoir City to Rockwood in the near future, changing system from 19,000 to 66,000 volts.

ANNISTON, ALA. — A committee has been appointed by local business men to organize a company to build an electric or a gas-electric railway from Anniston to Camp McClellan. W. H. Weatherly, L. L. Crump and others are interested in the project.

DECATUR, ALA.—The construction of an electric railway from Decatur to Florence, Sheffield and Tuscumbia, a distance of about 45 miles, is under consideration. H. L. Morrill and D. S. Echols of Decatur, and C. E. Warwick of Vicksburg, Miss., are interested in the project.

DANVILLE, ARK.—The installation of an electric-lighting system in Danville is reported to be under consideration.

HELENA, ARK.—Bids, it is reported, are being received by the A. M. Richardson Lumber Company of Helena, recently incorporated, for equipment for power plant and mill. A. M Richardson is one of the incorporators.

LITTLE ROCK, ARK.—The Arkansas Battery Company of Little Rock is planning to equip a plant and will purchase machinery to cost about $10,000. W. P. Galloway is president.

PARAGOULD, ARK.—The plant of the Henry Wrape Company, manufacturer of staves, etc., including machinery, boilers, engines and other equipment, was destroyed by fire, causing a loss of about $75,000.

PINE BLUFF, ARK.—H. J. Burkhart of Pine Bluff is reported to be contemplating equipping a woodworking plant, at a cost of about $250,000.

PRAGUE, OKLA.—Arrangements are being made by the city of Prague for the erection of an electric transmission line south and west to connect with the transmission system of the Oklahoma Power Transmission Company. The work will include the erection of 22 miles of transmission line, an outdoor substation, equipped with three 75-kva., 33,000/2300-volt, single-phase transformers, two 500-gal. per minute motor-driven centrifugal pumps, directly connected, air compressor, etc. Bids, it is understood, have been received for the above equipment.

SHATTUCK, OKLA.—Bonds to the amount of $75,000 have been voted for rebuilding the municipal electric-light plant and water-works system.

STILLWATER, OKLA.—Bids will be received by the State Board of Agriculture, Capitol Building, Oklahoma City, until June 4 (extension of date from May 2), for the erection of two buildings at the Agricultural and Mechanical College, including electrical work, etc. The cost of the building is estimated at $200,000. F. M. Gault is president.

WALTER, OKLA.—The Blue Ribbon Oil & Refining Company, recently organized, is reported to be in the market for equipment for a 10,000-barrel pumping station and a refinery with a daily capacity of 5000 barrels. John Aldridge of Oklahoma City is president and general manager.

BANGS, TEX.—Martin & Davis are planning to rebuild their cotton gin, recently destroyed by fire. The cost is estimated at about $200,000.

BRACKETTVILLE, TEX.—Extensive improvements and extensions, it is reported, are contemplated to the municipal electric-light plant.

McKINNEY, TEX.—The capital stock of the McKinney Telephone Company has been increased from $45,000 to $125,000, the proceeds to be used for extensions and improvements to its system.

Pacific and Mountain States

HANFORD, WASH. — Application has been filed at the land office by the Blackrock Power & Irrigation Company asking for an easement for the erection of a high-tension electric transmission line from Hanford to Priest Rapids, a distance of 35 miles. The company, it is assumed, contemplates irrigating a large tract of land lying above the proposed high line canal.

SEATTLE, WASH.—Plans are being prepared by Daniel Huntington, city architect for the addition of another floor to the municipal auxiliary steam-driven electric plant at Eastlake Avenue and Nelson Place. The additional space is to be utilized as an electrical testing laboratory.

SEATTLE, WASH.—Contract has been awarded by the Puget Sound Traction, Light & Power Company to the Stone & Webster Engineering Corporation of Boston, Mass., for the construction of a new coal-conveyor, concrete tunnels and hopper adjacent to its power house at 6600 Fourteenth Avenue, S.

SEATTLE, WASH —Arrangements have been made by the City Lighting Department to purchase the surplus energy generated by the Stimson Mill Company at Ballard by using the waste material at the mill for fuel. The company agrees to deliver 1300 kw. for 12 hours and 300 kw. for the remaining 10 hours of the day at 0.4 cent per kilowatt-hour.

SEATTLE, WASH. — The Northwest Trading Company of Seattle is in the market for equipment for an electric-light and power plant of about 3000 kw. capacity. A turbine generating set is preferred, otherwise suitable generators directly connected to reciprocating engines, or an offer for any plant from 1500 up to 3000 kw. The electrical system must be three-phase, 6600 volts, 50 cycles. Auxiliary apparatus including suitable boilers for coal, fuel and surface type condensing apparatus with cooling water figured at 75 deg. Fahr, is desired.

TACOMA, WASH.—Bids will be received by Hamilton F. Gronen, commissioner of light and water, Tacoma, until June 3 for furnishing the annual supply of incandescent lamps in accordance with specifications on file in the office of the commissioner.

WALLA WALLA, WASH.—As the first step toward the construction of a hydro-electric power plant to be run in connection with the municipal water-works system, the City Commissioners have ordered a survey of Mill Creek between the intake and Tiger Canyon. It is estimated that sufficient power can be obtained from Mill Creek to pump the water from the deep wells.

WATERVILLE, WASH.—Application has been made to the Douglass County Commissioners by the Chelan Falls Power Company for permission to construct and maintain an electric transmission line in Douglas County.

GOLD HILL, ORE.—The sale of the Rogue River Public Service Corporation's properties in Jackson and Josephine Counties to Newton W. Roundtree of Portland, for a sum just sufficient to cover the court charges, and subject to the bonded indebtedness, has been confirmed by the United States District Court. The holdings include a large acreage in the two counties and the power plants and franchises at Grants Pass and Gold Hill, with transmission lines and franchises in both cities.

PORTLAND, ORE.—Preparations, it is reported, are being made by the Pacific Power & Light Company for the erection of a 6600-volt, three-phase transmission line to supply service to two beet-sugar factories of the Utah-Idaho Sugar Company. The company is also planning to build a new outdoor substation near Kahlotus.

REEDSPORT, ORE.—Preliminary plans are being prepared by the Umpqua Light & Power Company for the construction of a new electric transmission line across the Umpqua River at Reedsport. The Umpqua company recently took over the property of the Gardiner (Ore.) Light & Power Company.

BERKELEY, CAL.—The contract awarded the Pacific Fire Extinguisher Company by the City Council for street lighting has been declared void by the District Court of Appeals in the district embraced by Derby, Warren and Garber Streets.

BISHOP, CAL.—Plans are being considered by the Nevada-California Power Company of Riverside for the erection of a high-tension transmission line to Ely, Nev., to cost about $300,000.

BOLINAS, CAL.—The Chetco Mining Company is contemplating the installation of electrically driven pumping equipment at its local properties.

FRESNO, CAL.—Plans have been prepared for the installation of an electrolier-lighting system on South Van Ness Avenue.

LA MANDA PARK, CAL.—Tentative boundaries for a county lighting district have been located by the lighting committee. The proposed district extends from the Pasadena City limits to Oak Avenue and north from Colorado Street to White Street.

MARICOPA, CAL.—The Side Hill Oil Company has contracted with the San Joaquin Light & Power Corporation of Fresno to supply electricity for drilling and pumping of all wells on its property. Steam power will be used until the transmission line can be extended to the mine.

ONTARIO, CAL.—Plans have been approved for the erection of a new power house by the Ontario Power Company, to cost about $60,000. It is proposed to build the new power plant just above Hog's Back, in San Antonio Canyon. It is expected to have the plant completed by Jan. 1. 1919.

REDDING, CAL.—Application has been field by the city of Redding with the State Railroad Commission for an appraisal of the electrical distribution system of the Northern California Power Company in Redding. The city proposes to establish a municipal plant, for which $40,000 in bonds have been voted.

RED BLUFF, CAL.—The installation of a municipal electric-lighting system in Red Bluff is under consideration.

SANTA ANA, CAL.—Plans have been filed by Kaufman & Sons of Santa Ana for the erection of a new factory at 1625 East First Street. The company manufactures spot lamps.

SANTA BARBARA, CAL.—A movement is under way for the installation of ornamental lamps on Anapamu Street from State Street to Anacapa. The proposed plans provide for removing overhead wires and placing them in conduits.

BONNERS FERRY, IDAHO.—The property of the Bonner Water & Light Company has been offered to the city for $80,000. The first offer made through a bonding house several weeks ago was for $125,000.

SANDPOINT, IDAHO.—The Falls Creek Mining Company is contemplating the installation of a power plant to furnish power for its proposed mill and compressor. The plans provide for the construction of a penstock 900 ft. long, providing for a fall of 260 ft.

OGDEN, UTAH.—The power station and car barns of the Bamberger Electric Railroad Company were recently destroyed by fire, causing a loss of about $750,000.

BUTTE, MONT.—Improvements involving an expenditure of about $70,000, are contemplated by the Butte Electric Railway Company in the near future. The proposed work will include double-tracking, new switches, etc.

HARLOWTON, MONT.—Work has begun on the installation of electrically driven machinery throughout the entire plant of the Montana Flour Mills Company, to replace steam power. Electricity to operate the mill will be furnished by the Montana Power Company.

COPPERFIELD, NEV. — The Washoe Copper Company of Copperfield is contemplating the erection of a new forge shop, engine plant and compressor works at its new plant near the Nixon-Nevada property. Copperfield has no post office.

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GRANDE PRAIRIE, ALTA.—Plans are being prepared by the Town Council for the installation of an electric-lighting system, to cost about $6 000.

CLOVERDALE, B. C.—The Whitlock Waterworks, Ltd., has contracted with the British Columbia Electric Railway Company for an extension of the electric transmission line to the waterworks pumping station. Preparations are being made to replace the gasoline engine with electric motors.

MISSION, B. C.—Extensions are contemplated to the plant of the King Beach Company of Mission, including the installation of additional boiler equipment.

NEW WESTMINSTER, B. C.—The Timberland Lumber Company is erecting a saw mill on the Fraser River, to cost about $100,000.

REVELSTOKE, B. C.—Improvements are contemplated by the Lanark Mines Company, including the construction of a power plant and installing equipment. W. B. Dornberg of Spokane, is manager.

SYDNEY, N. S.—The Dominion Coal Company, it is reported, contemplates a power development at New Waterford, including the erection of a large power station.

COBALT, ONT.—The power house at the Penn Canadian Mine was recently damaged by fire, causing a loss of about $5,000.

LEASIDE JUNCTION, ONT. — The Canadian Northern Railway Company is planning to build a roundhouse, coaling plant, ice house, etc., at Leaside Junction. George C. Briggs of Toronto is architect.

PERTH, ONT.—Plans are being considered for remodeling the street-lighting system this spring. It is proposed to change it from 133 to 60 cycles.

SAULT STE. MARIE, ONT.—The power plant of the Great Lakes Power Company was damaged by fire recently, causing a loss of about $150,000. The plant will be rebuilt at once.

TORONTO, ONT.—Foundations are being laid for machine shop, blacksmith shops, pipe and electric shops at the plant of the Dominion Shipbuilding Company, located at the foot of Bathurst Street. The main building will be 485 ft. by 220 ft. The company has contracts for the construction of 12 steel ships.

LEVIS, QUE.—The Levis County Railway Company, it is reported, contemplates improvements to its system involving an expenditure of about $150,000.

REGINA, SASK. — Improvements are contemplated to the municipal electric-light plant, involving an expenditure of from $175,000 to $200,000, and will include the installation of a 5000-kw. electric generating unit.